REPORT NUMBER: 214P-MGA-2011-002

SAFETY COMPLIANCE TESTING FOR FMVSS 214
DYNAMIC SIDE IMPACT PROTECTION
RIGID POLE

NISSAN MOTOR CO., LTD.
2011 NISSAN ALTIMA S 4-DR SEDAN
NHTSA NUMBER: CB5204

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

Test Date: March 9, 2011

Report Date: April 14, 2011

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, SE
WEST BUILDING (NVS-220)
WASHINGTON, DC 20590

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Prepared by: 
Donna Janovicz, Project Manager

Approved by: 
Joe Fleck, Project Engineer

Approval Date: April 14, 2011

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted by: James A. Jones

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Technical Report Documentation Page

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7. Author(s) Donna Janovicz, Project Manager Joe Fleck, Project Engineer		*8. Performing Organization Report No.* 214P-MGA-2011-002
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-07-D-00062
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave, SE Washington, DC 20590		*13. Type of Report and Period Covered:* Final Test Report 3/09/2011 to 4/14/2011 *14. Sponsoring Agency Code* NVS-220
15. Supplementary Notes		

16. Abstract

A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 2011 Nissan Altima S 4-Dr Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-01 for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at MGA Research Corporation, in Burlington, Wisconsin, on March 9, 2011.

The impact velocity was 31.5 km/h, and the ambient temperature at the struck (driver's) side of the test vehicle at the time of impact was 21°C. The test vehicle post-test maximum crush was 393 mm at level 3. The test vehicle's performance follows:

Measurement Description	Units	Result
Head Injury Criteria (HIC_{36})	N/A	373
Max. Rib Deflection	mm	26
Sum of Abdomen Forces	N	1388
Pubic Symphysis Force	N	2543

The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite side doors did not open during the side impact event.

17. Key Words Compliance Testing Side Impact Protection Pole Test ES-2re SID-IIs		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services (TIS) Room E12-100 East Building 1200 New Jersey Ave. Washington, D.C. 20590 Telephone No. (202) 366-2588	
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Form DOT F1700.7 (8-72)

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PURPOSE AND SUMMARY OF TEST

PURPOSE

This side impact test is part of the FY 2011 FMVSS 214 Side Impact Protection Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-07-D-00062. The purpose of this test was to evaluate side impact protection in a 2011 Nissan Altima S 4-Dr Sedan. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-214P-01, dated January 2010).

SUMMARY

A rigid pole side impact test was conducted on a 2011 Nissan Altima S 4-Dr Sedan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 31.5 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin, on March 9, 2011. Pre-test and post-test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

One Part 572U dummy was placed in the left front outboard designated seating position according to instructions specified in TP-214P-01, dated January 2010. The side impact event was documented by ten (10) cameras.

The ES-2re male dummy was instrumented with a triaxial accelerometer pack located in the head, 3 rib displacement transducers located in the chest, 3 load cells located in the abdomen and a load cell located in the pubic symphysis.

A summary of the test results follows:

DUMMY INJURY VALUES

Dummy	HIC (36ms)	Thorax Deflection (mm)		Abdomen Forces (N)		Pubic Symphysis (N)
ES-2re 50th Percentile Male	373	Upper	25.8	Front	374.1	2542.9
		Middle	22.8	Mid	469.1	
		Lower	25.3	Rear	586.6	
		Max.	25.8	Sum	1387.6	

GENERAL COMMENTS

There was no valid data collected for:

Left Mid A-Post Y after 20 msec.
Driver Seat Track Y after 15 msec.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1

TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

VEHICLE INFORMATION	
Make	Nissan
Model	Altima S
Body Style	Sedan
VIN	1N4AL2AP4BN432797
Body Color	Brilliant Silver
Engine Displacement (L)	2.5
# of Cylinders	4
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	Yes
Final Drive	Front
Odometer Reading	117 miles

OPTIONS	
ESC	Yes
All Wheel Drive	No
Power Steering	Yes
Tilt Steering Wheel	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso/Pelvis Airbag	Yes
Driver Knee Bag	No
Driver Seat Belt Pretentioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seat	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso Airbag	No
Rear Pass. Seat Belt Pretentioners	No
Rear Pass. Seat Belt Load Limiters	No
Rear Pass. Power Seats	No
Power Windows	Yes
Air Conditioning	Yes
AM/FM CD	Yes
Automatic Door Locks (ADL)	Yes
Does owner's manual provide instructions to disable ADL's?	No
Anti-Lock Brakes	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Nissan Motor Co., Ltd.
Date of Manufacture	11/10

GVWR (kg)	1941
GAWR Front (kg)	1017
GAWR Rear (kg)	993

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	60/40 Split		
Number of Occupants	2	3		5
Capacity Weight (VCW) (kg)				408
Cargo Weight (RCLW) (kg)				68

DATA SHEET NO. 2

GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	kPa	220	220	220	220
As Tested	kPa	220	220	220	220

TEST VEHICLE WEIGHTS

	Units	As Delivered			Fully Loaded			As Tested		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	432.7	295.7		460.4	361.5		464.0	357.4	
Right	kg	431.4	282.2		427.3	337.5		430.0	328.9	
Ratio	%	59.9	40.1		55.9	44.1		56.6	43.4	
Totals	kg	864.1	577.9	1442.0	887.7	699.0	1586.7	894.0	686.3	1580.3

TEST VEHICLE TARGET WEIGHT (TVTW) CALCULATION

Measured Parameter	Units	Value
As Delivered Weight	kg	1442.0
Weight of 1 P572U ATD (ES-2re) Dummy	kg	77.1
Rated Cargo/Luggage Weight (RCLW)	kg	68
Calculated Target Vehicle Test Weight (TVTW)	kg	1587.1

TEST VEHICLE ATTITUDES

	Units	LF	RF	RR	LR
Fully Loaded	mm	711	718	686	700
As Tested	mm	711	718	701	704
Difference	mm	0	0	-18	3

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Parameter	Units	Value
Test Vehicle Wheel Base	mm	2775
Vertical Impact Reference Line (Aft of Front Axle)	mm	1330

WEIGHT of BALLAST and VEHICLE COMPONENTS REMOVED TO MEET VEHICLE TEST WEIGHT

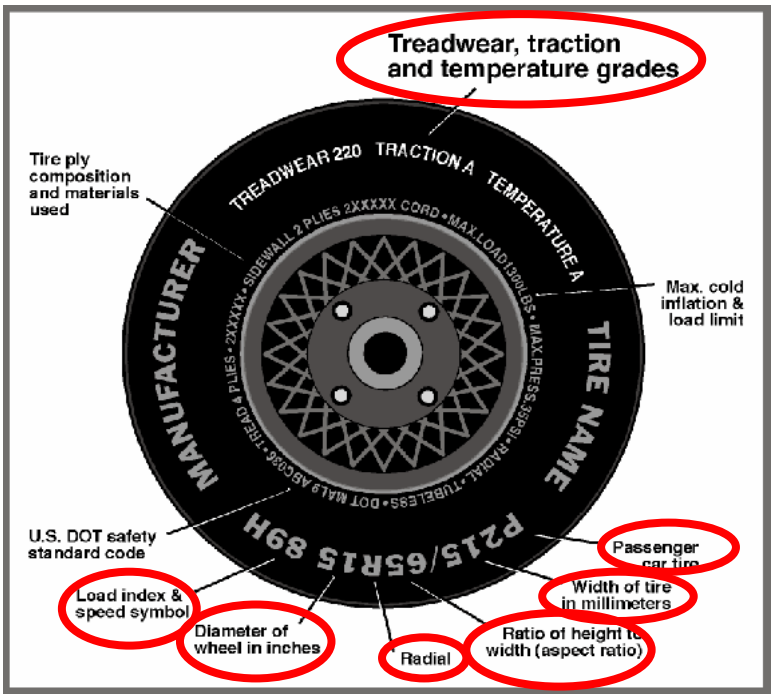
Description of Component	Weight (kg)
Ballast	0
Trunk Lining/Engine Cover/Rear Floor Mats	3.2
Right Rear Door Panel/Window/Speaker	7.3
Right Taillight/Right Front Headrest	3.2

DATA SHEET NO. 3

VEHICLE TIRE INFORMATION

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommended Tire Size	P215/60R16	P215/60R16
Tire Size on Vehicle	P215/60R16	P215/60R16
Tire Manufacturer	Continental	Continental
Tire Name	Conti Pro Contact	Conti Pro Contact
Tire Type	Passenger	Passenger
Tire Width	215	215
Aspect Ratio	60	60
Radial	Yes	Yes
Wheel Diameter	16	16
Load Index/Speed Symbol	94T	94T
Treadwear	540	540
Traction Grade	A	A
Temperature Grade	A	A

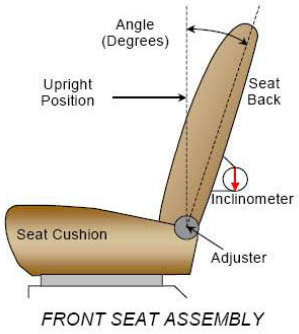
DATA SHEET NO. 4

SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle:	2011 Nissan Altima S 4-Dr Sedan	NHTSA No.	CB5204
Test Program:	FMVSS 214 Pole	Test Date:	3/09/2011

NORMAL DESIGN RIDING POSITION

The driver seat back is positioned to the manufacturer's designated angle. The procedure is as follows: Seat back angle is measured at the headrest post by using inclinometer zeroed at the door sill. When the seat back is in the full forward most locked position (notch is 0) recline the seat back rearward 7 notches. Each notch is 2 degrees measured at the headrest post.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLE

	Degrees	Detents
Driver with Seated Dummy	2.4° at headrest post	7th notch (forward-most as 0)

SEAT FORE/AFT POSITION

The method used for determining seat fore/aft position is as follows: For seat track adjustments, set in mid track position.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Front Seat	25 detents	12th detent (forward-most as 0)

SEAT BELT UPPER ANCHORAGE

The method of positioning the seat belt upper anchorage is as follows: Detents to the nominal design position are measured with respect to the uppermost detent. Place at 0 detent for the 50th percentile male.

SEAT BELT UPPER ANCHORAGE

	Total # of Positions	Placed in Position #
Driver Seat	4 detents	0 detent (uppermost detent defined as 0)

HEADREST RESTRAINT

The headrest was placed in the uppermost position.

DATA SHEET NO. 5

FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

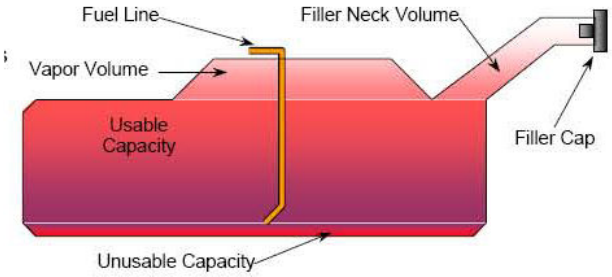
Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

FUEL TANK CAPACITY

	Liters
Usable Capacity (Form 1)	75.6
Usable Capacity (Owner's Manual)	75.6
92-94% of Usable Capacity	69.6 to 71.1
Actual Amount of Solvent Used	70.4

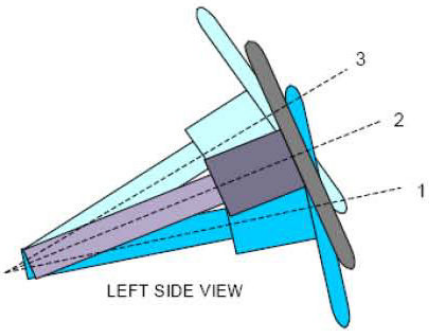
FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe. The test vehicle is equipped with an electric fuel pump. The fuel pump will pump fuel: 1) for 1.0 seconds after the ignition is switched to "ON", 2) while the engine is running, 3) for 1.5 seconds after the engine stops running. The fuel pipe is on the left side.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



STEERING COLUMN ASSEMBLY

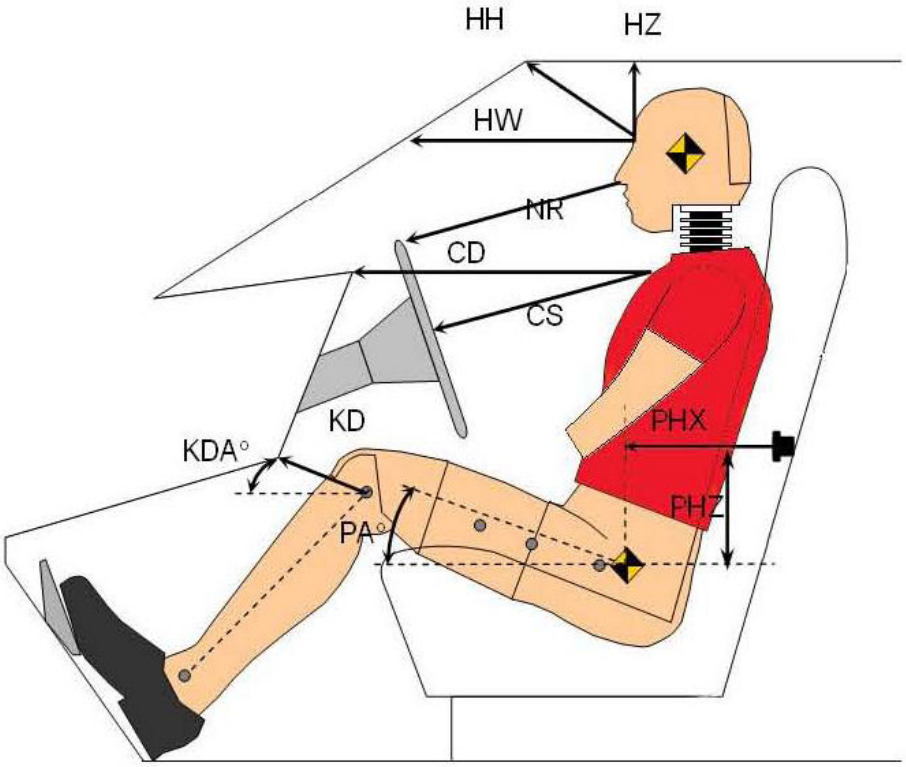
STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	73.6	256
Geometric Center – Position 2	65.3	236
Uppermost – Position 3	56.9	216
Telescoping Steering Wheel Travel		40
Test Position	67.7	236

.DATA SHEET NO. 6

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

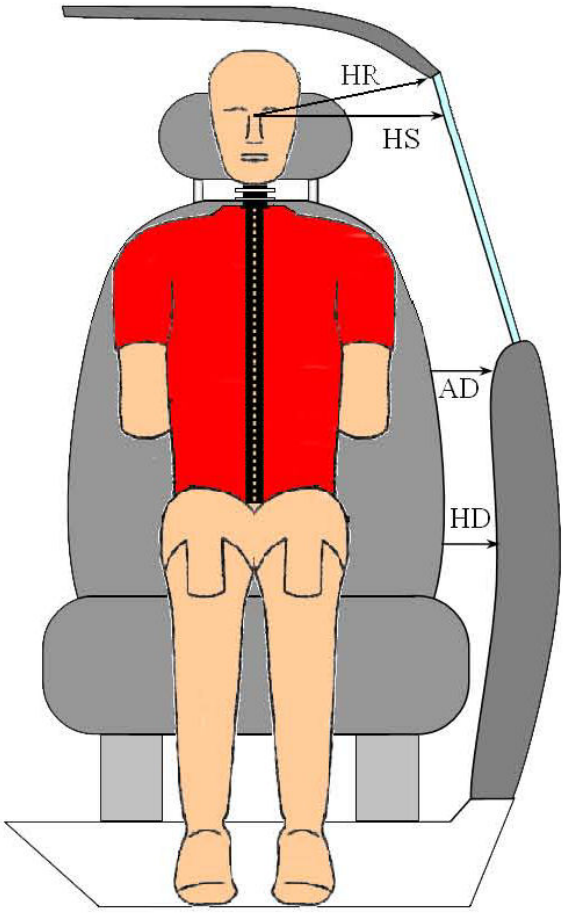


Driver Code	Measurement Description	Length (mm)	Angle (°)
HH	Head to Header	370	
HW	Head to Windshield	573	
HZ	Head to Roof	147	
NR	Nose to Rim	407	
CD	Chest to Dash	547	
CS	Chest to Steering Wheel	320	
KDL	Left Knee to Dash	187	14.4
KDR	Right Knee to Dash	135	16.4
PA	Pelvic Angle		
PHX	H-Point to Striker (X-Axis)	209	
PHZ	H-Point to Striker (Z-Axis)	130	

DATA SHEET NO. 7

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

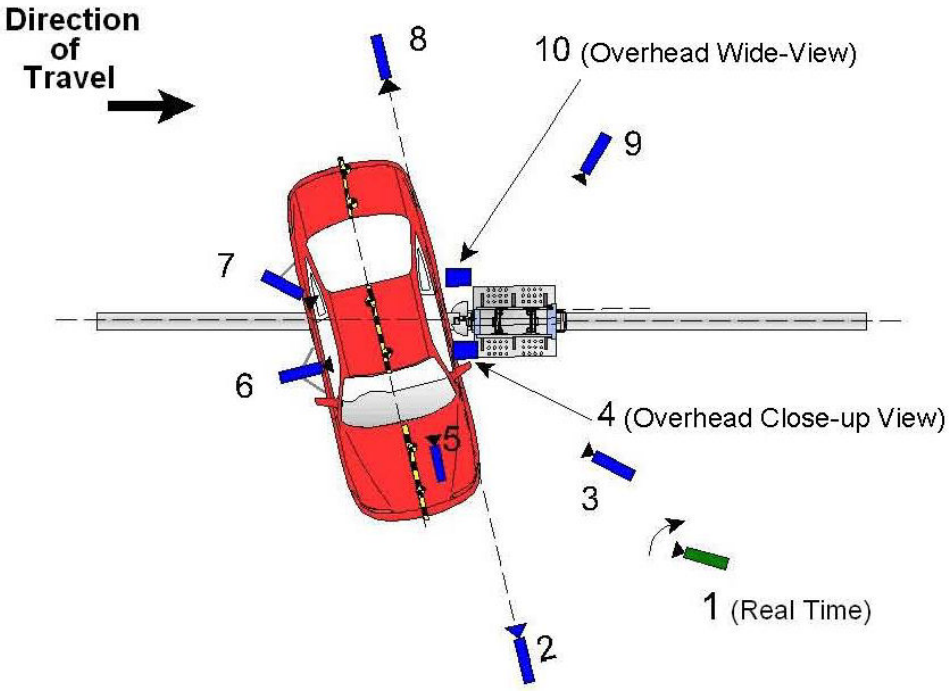


Code	Measurement Description	Units	Front Occupant
HR	Head to Side Header	mm	183
HS	Head to Side Window	mm	298
AD	Arm to Door	mm	109
HD	H-Point to Door	mm	165

DATA SHEET NO. 8

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011



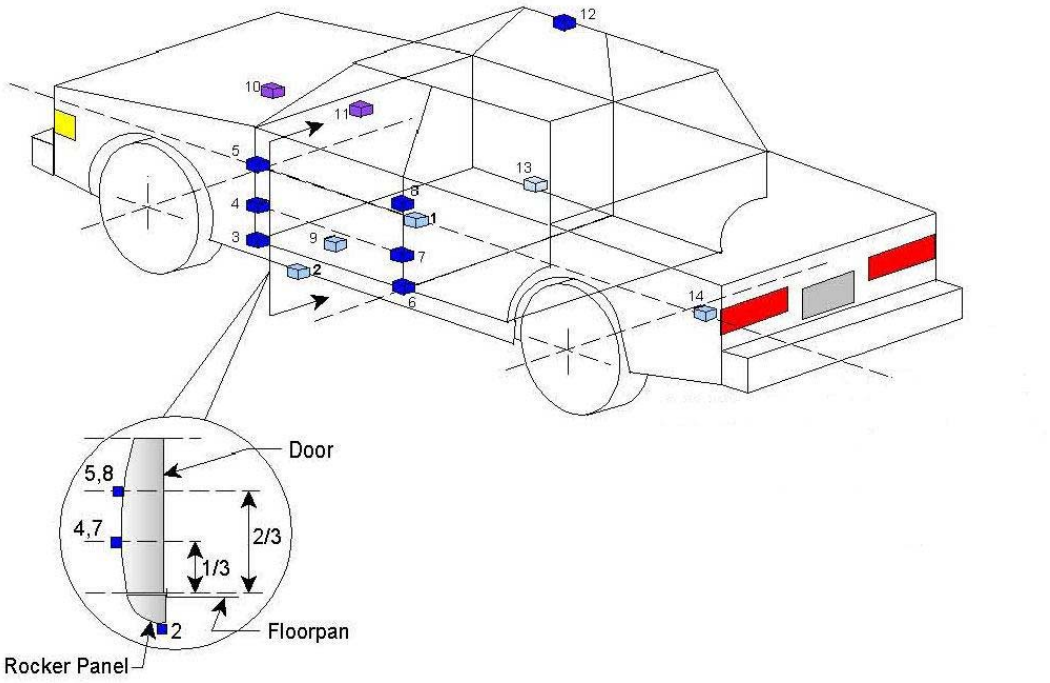
Reference: From Point of Impact for X and Y; from Ground for Z):
+X = Right of Impact, + Y = Forward of Impact, +Z = Up

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X	Y	Z		
1	Real-Time					30
2	Front Ground Level	5820	40	1750	24	1000
3	Impact Side 45° Forward	4380	2070	1860	20	1000
4	Overhead Closeup	0	-70	4520	50	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-5670	50	1730	24	1000
9	Impact Side 45° Rearward	-3740	3870	1880	20	1000
10	Overhead Wide	0	-350	4610	14	1000

DATA SHEET NO. 9

TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011



Loc. No.	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2626	-132	-177
2	Left Floor Sill	2777	-732	-215
3	A Pillar Sill	3321	-740	-210
4	A Pillar Low	3305	-708	-524
5	A Pillar Mid	3352	-798	-739
6	B Pillar Sill	2148	-733	-220
7	B Pillar Low	2172	-725	-510
8	B Pillar Mid	2192	-710	-760
9	Seat	2282	-569	-210
10	Engine	4096	38	-794
11	Firewall	3792	0	-911
12	Roof	2174	555	-1472
13	Floor Sill	2126	733	-235
14	Rear Deck	235	0	-284

Reference: X – Test Vehicle Rear Bumper (+ forward)
Y – Test Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

DATA SHEET NO. 10

TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

Loc. No.	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	7.5	28.5	-11.7	50.6
	Vehicle CG (Y)	24.5	36.2	-48.2	50.4
	Vehicle CG (Z)	19.9	36.6	-19.8	31.9
	Resultant	50.3	50.3		
2	Left Floor Sill (Y)	75.7	12.8	-15.6	42.5
3	A Pillar Sill (Y)	16.3	37.4	-2.9	50.8
4	A Pillar Low (Y)	20.2	19.1	-4.4	23.2
5	A Pillar Mid (Y)	(1)	(1)	(1)	(1)
6	B Pillar Sill (Y)	43.4	12.6	-2.0	300.0
7	B Pillar Low (Y)	43.2	15.9	-13.5	23.1
8	B Pillar Mid (Y)	29.4	43.5	-11.9	15.6
9	Seat (Y)	(2)	(2)	(2)	(2)
10	Engine (X)	4.4	151.1	-19.0	38.0
	Engine (Y)	7.9	107.5	-2.5	245.3
11	Firewall (Y)	9.3	58.5	-1.7	3.5
12	Roof (Y)	23.9	39.6	-0.7	266.9
13	Floor Sill (Y)	12.5	31.8	-1.3	300.0
14	Rear Deck (X)	3.0	224.5	-6.3	26.5
	Rear Deck (Y)	15.1	35.8	-3.0	227.5

(1) No valid data collected for Left Mid A-Post Y after 20 msec.
(2) No valid data collected for Driver Seat Track Y after 15 msec.

DATA SHEET NO. 11

DUMMY INJURY RESPONSE DATA

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

Dummy S/N	Positive		Negative	
	MAX	TIME (ms)	MAX	TIME (ms)
HEAD ACCELERATION (G)				
Longitudinal (X)	4.2	96.3	27.0	53.9
Lateral (Y)	50.7	56.9	14.2	111.5
Vertical (Z)	13.8	42.4	1.6	153.3
Resultant (R)	56.7	55.6		
HIC36 (t1, t2)	373		t1 = 42.5	t2 = 66.5
THORAX DEFLECTION (mm)				
Upper Rib			25.8	49.5
Middle Rib			22.8	48.4
Lower Rib			25.3	49.1
ABDOMINAL FORCES (N)				
Front	374.1	48.9		
Middle	469.1	49.8		
Rear	586.6	48.6		
Sum	1387.6	48.7		
PELVIS FORCE (N)				
Pubic Symphysis			2542.9	54.4

Reference: Positive Direction -Longitudinal (X) = forward
-Lateral (Y) = to right
-Vertical (Z) = down

DATA SHEET NO. 12

POST TEST OBSERVATIONS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

TEST DUMMY INFORMATION AND CONTACT

Description	Front Occupant
Dummy Type / Serial No.	ES-2re / 016
Head Contact	Curtain Airbag, Headrest
Upper Torso Contact	Side Airbag, Door Panel
Lower Torso Contact	Side Airbag, Door Panel
Left Knee Contact	Door Panel
Right Knee Contact	Left Knee

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Doors	Remained closed and jammed shut	Remained closed and jammed shut
Right Side Doors	Remained closed and operational	Remained closed and operational
Hatch and Other Doors		
Seat Movement	0	0
Seat Back Failure	None	None

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	None
Windshield Damage	Cracked
Window Damage	Left Front Window Broke
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

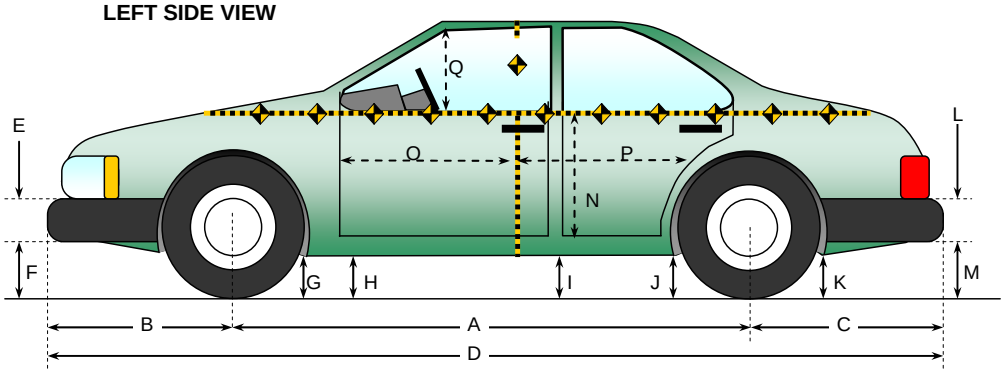
Restraint Type	Front Occupant	
	Installed	Operated
Frontal Airbag	Yes	No
Side Torso/Pelvis Airbag	Yes	Yes
Head Airbag	No	
Curtain Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	

DATA SHEET NO. 13

VEHICLE PRE TEST AND POST TEST MEASUREMENTS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

LEFT SIDE VIEW

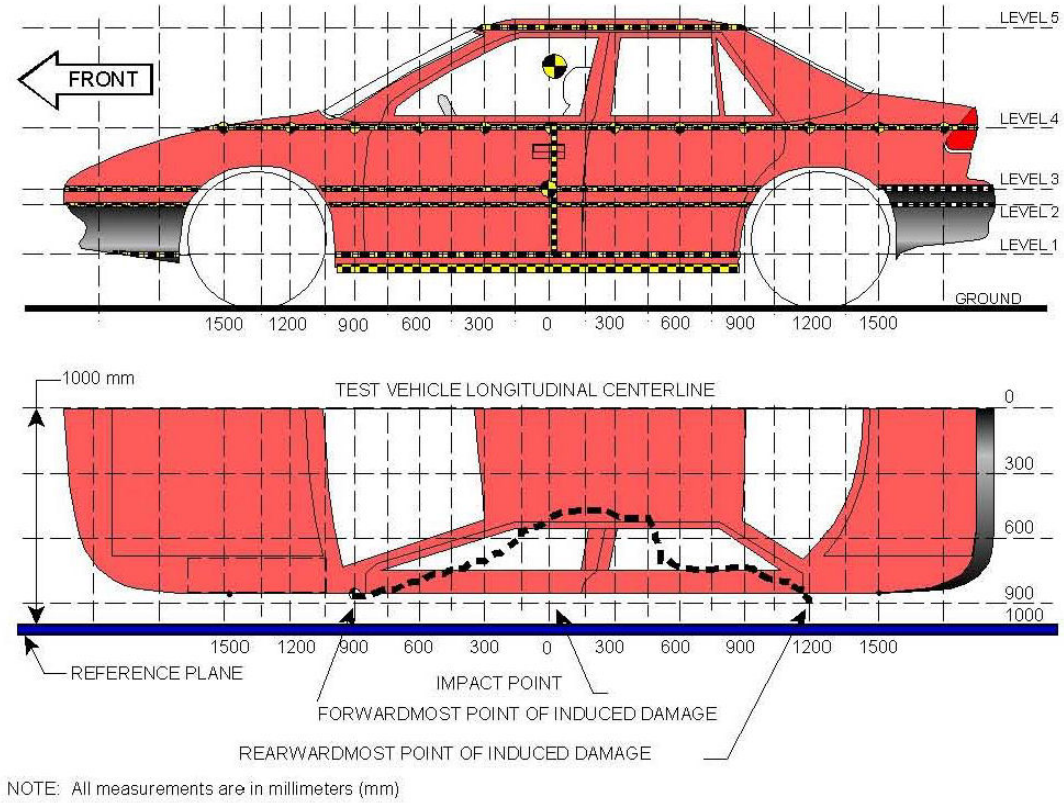


Code	Measurement Description	Pre-Test (mm)	Post-Test (mm)	Difference (mm)
A	Wheelbase	2775	2685	90
B	Front Axle to FSOV	985	976	9
C	Rear Axle to RSOV	1105	1108	-3
D	Total Vehicle Length at Centerline	4866	4769	97
E	Front Bumper Thickness	105	105	0
F	Front Bumper Bottom to Ground	216	241	-24
G	Sill Height at Front Wheel Well	182	191	-9
H	Sill Height at Front Door Leading Edge	176	183	-7
I	Sill Height at B Pillar	181	204	-23
J1	Sill Height at Rear Wheel Well	194	207	-13
J2	Pinch Weld Height at Rear Wheel Well	192	211	-19
K	Sill Height Aft of Rear Wheel Well	217	203	14
L	Rear Bumper Thickness	105	105	0
M	Rear Bumper Bottom to Ground	288	282	6
N	Sill Height to Window Bottom Sill	701	723	-22
O	Front Door Leading Edge to Impact CL	940	933	7
P	Rear Door Trailing Edge to Impact CL	1087	1112	-25
Q	Front Window Opening	478	428	50
R	Right Side Length	3520	3530	-10
S	Left Side Length	3520	3395	125
T	Vehicle Width at B Post	1785	1600	185

DATA SHEET NO. 14

EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011



NOTE: All measurements are in millimeters (mm)

Maximum Exterior Crush Measurements

Level	Measurement Description	Maximum Exterior Static Crush	Distance from Impact	Height Above Ground (mm)
1	Sill Top	341	0	255
2	Occupant H-Point	390	0	545
3	Mid-Door	393	0	617
4	Window Sill	319	0	916
5	Window Top	115	-75	1412

DATA SHEET NO. 15

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

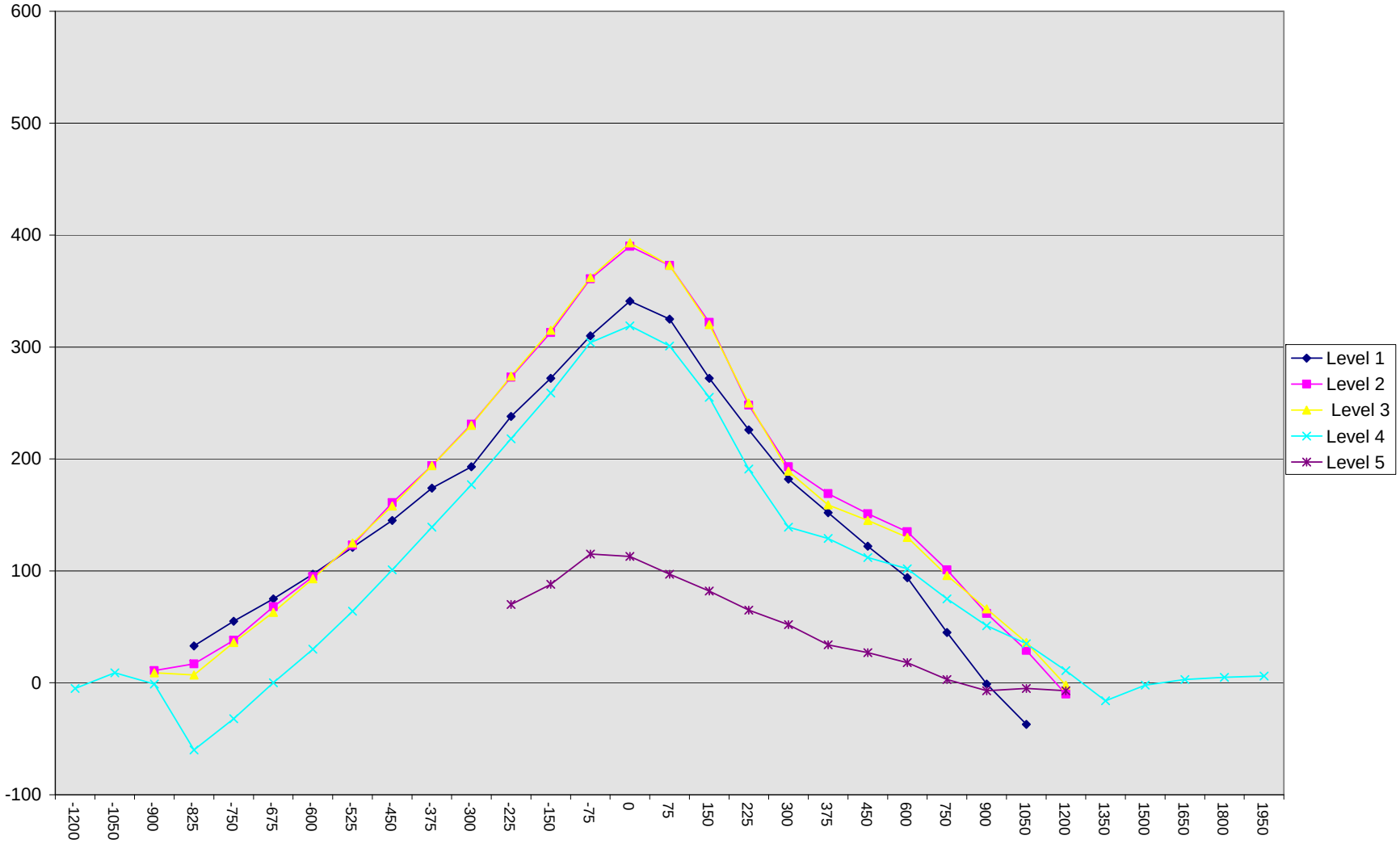
	Level 1	Level 2	Level 3	Level 4	Level 5
Maximum Crush (mm)	341	390	393	319	115
Distance From Impact (mm)	0	0	0	0	-75

	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1200				318					313					-5	
-1050				307					316					9	
-900		200	199	299			211	208	298			11	9	-1	
-825	233	201	206	291		266	218	213	231		33	17	7	-60	
-750	246	206	206	287		301	244	242	255		55	38	36	-32	
-675	246	205	206	283		321	273	269	283		75	68	63	0	
-600	247	205	205	283		344	300	298	313		97	95	93	30	
-525	247	205	205	281		368	328	330	345		121	123	125	64	
-450	246	205	205	278		391	366	363	379		145	161	158	101	
-375	246	205	206	276		420	399	400	415		174	194	194	139	
-300	247	206	206	275		440	437	436	452		193	231	230	177	
-225	247	206	206	275	519	485	479	480	493	589	238	273	274	218	70
-150	247	206	206	273	519	519	519	521	532	607	272	313	315	259	88
-75	247	206	206	273	517	557	567	568	577	632	310	361	362	304	115
0	247	207	206	272	519	588	597	599	591	632	341	390	393	319	113
75	247	207	206	271	521	572	580	579	572	618	325	373	373	301	97
150	247	207	207	269	521	519	529	527	524	603	272	322	320	255	82
225	247	208	207	268	523	473	456	457	459	588	226	248	250	191	65
300	247	208	208	268	525	429	401	397	407	577	182	193	189	139	52
375	247	208	208	268	527	399	377	367	397	561	152	169	159	129	34
450	246	209	208	267	528	368	360	353	379	555	122	151	145	112	27
600	246	209	208	267	529	340	344	338	369	547	94	135	130	102	18
750	245	210	209	267	532	290	311	305	342	535	45	101	96	75	3
900	241	210	209	266	531	240	272	275	317	524	-1	62	66	51	-7
1050	224	207	208	264	534	187	236	244	299	529	-37	29	36	35	-5
1200		202	201	260	539		192	199	271	532		-10	-2	11	-7
1350				258					242					-16	
1500				261					259					-2	
1650				262					265					3	
1800				270					275					5	
1950				280					286					6	

DATA SHEET NO. 15 (CONTINUED)

VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011



DATA SHEET NO. 16

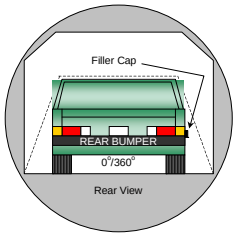
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

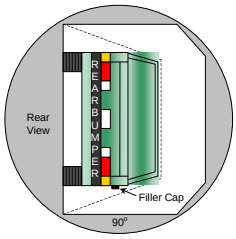
FUEL SYSTEM INTEGRITY POST IMPACT DATA

Time Interval	FMVSS 301 Maximum Allowable Spillage	Spillage (g)
Impact Until Motion Ceases	28 g	0
First Five Minutes Following Impact	142 g	0
Next 25 Minutes	28 g / 1 minute	0

STATIC ROLLOVER DATA



0/360



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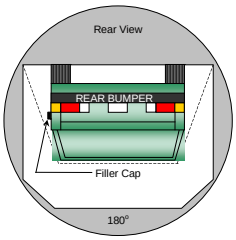
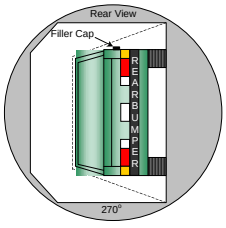


180



270

REAR VIEW

Rollover Stage	Rotation Time (spec. 1-3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0° - 90°	2	minutes	00	seconds	5	minutes	7	minutes	00	seconds	8	minutes
90° - 180°	1	minutes	56	seconds	5	minutes	6	minutes	56	seconds	7	minutes
180° - 270°	1	minutes	49	seconds	5	minutes	6	minutes	49	seconds	7	minutes
270° - 360°	1	minutes	58	seconds	5	minutes	6	minutes	58	seconds	7	minutes

Rollover Stage	Spillage (g)			
	First 5 min. from onset of rotation	6th min.	7th min.	8th min. (if required)
0° - 90°	0	0	0	
90° - 180°	0	0	0	
180° - 270°	0	0	0	
270° - 360°	0	0	0	
FMVSS 301 Maximum Allowable (for each 90° stage)	142	28	28	28

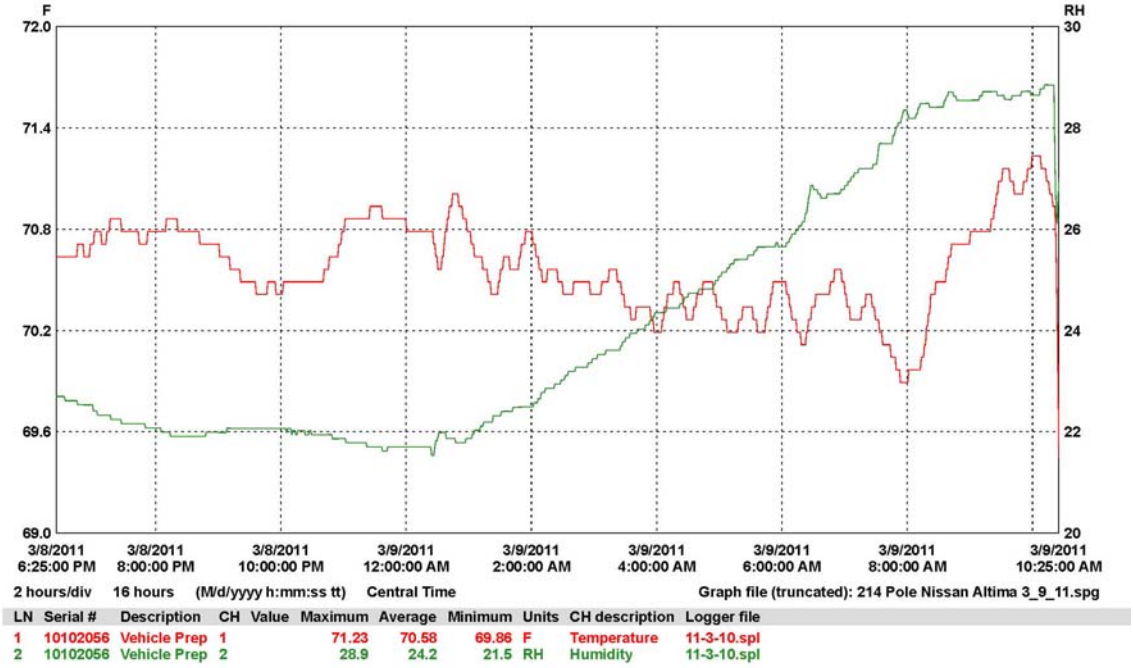
Rollover Stage	Spillage Location(s)
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

TEMPERATURE AND HUMIDITY TRACES

Test Vehicle: 2011 Nissan Altima S 4-Dr Sedan NHTSA No. CB5204
Test Program: FMVSS 214 Pole Test Date: 3/09/2011

Time of Impact: 10:20 am



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	10102056	Vehicle Prep	1		71.23	70.58	69.86	F	Temperature	11-3-10.spl
2	10102056	Vehicle Prep	2		28.9	24.2	21.5	RH	Humidity	11-3-10.spl

APPENDIX A

PHOTOGRAPHS

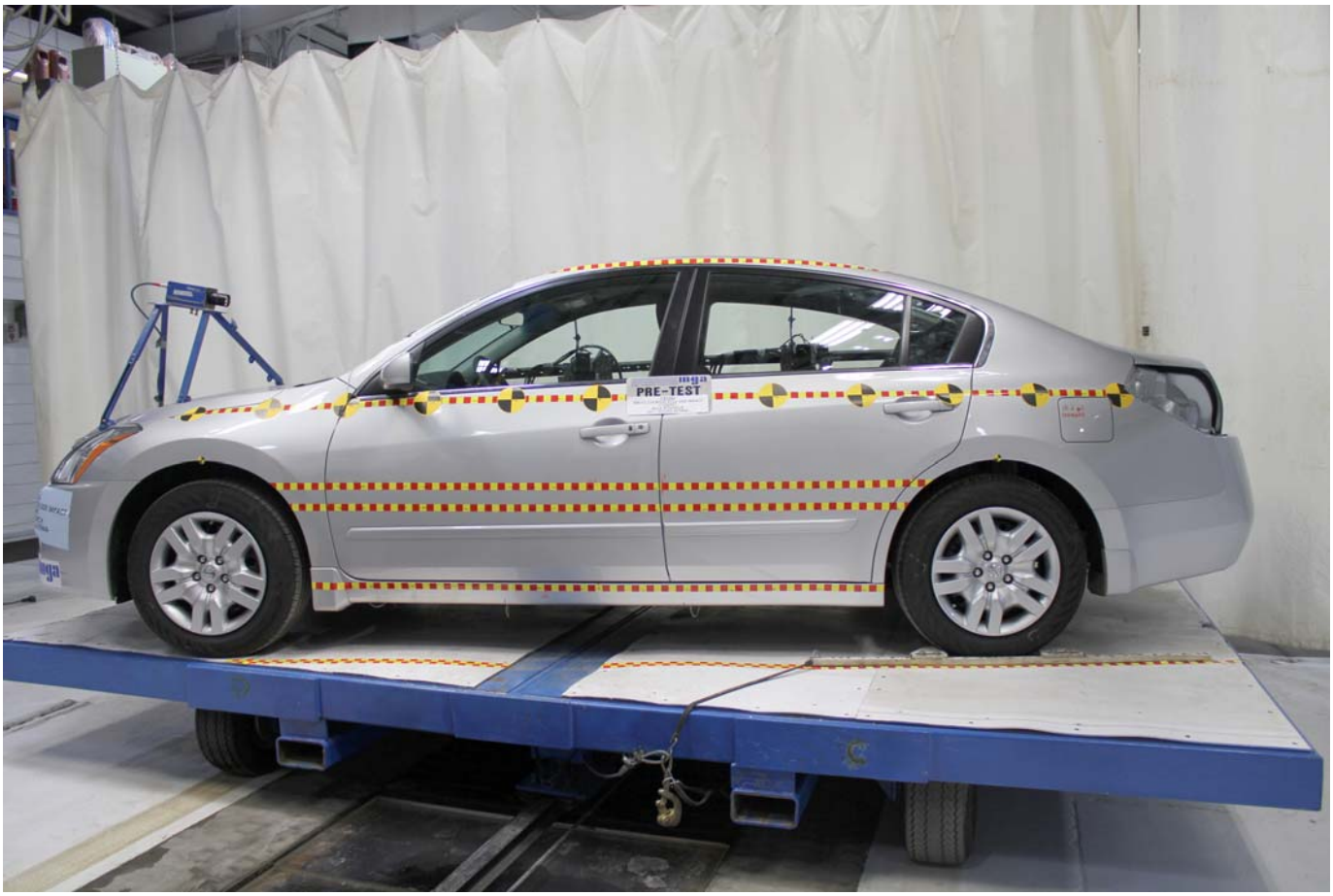
TABLE OF PHOTOGRAPHS

Pre-Test Frontal View of Test Vehicle

Post-Test Frontal View of Test Vehicle

Pre-Test Rear View of Test Vehicle

Post-Test Rear View of Test Vehicle



Pre-Test Impacted Side View of Test Vehicle

Post-Test Impacted Side View of Test Vehicle

Pre-Test Left ¾ Front View of Vehicle and Pole

Pre-Test Left ¾ Rear View of Vehicle and Pole

Pre-Test Overhead View of Test Vehicle

Post-Test Overhead View of Test Vehicle

Pre-Test Dummy Through Opposite Window

Post-Test Dummy Through Opposite Window

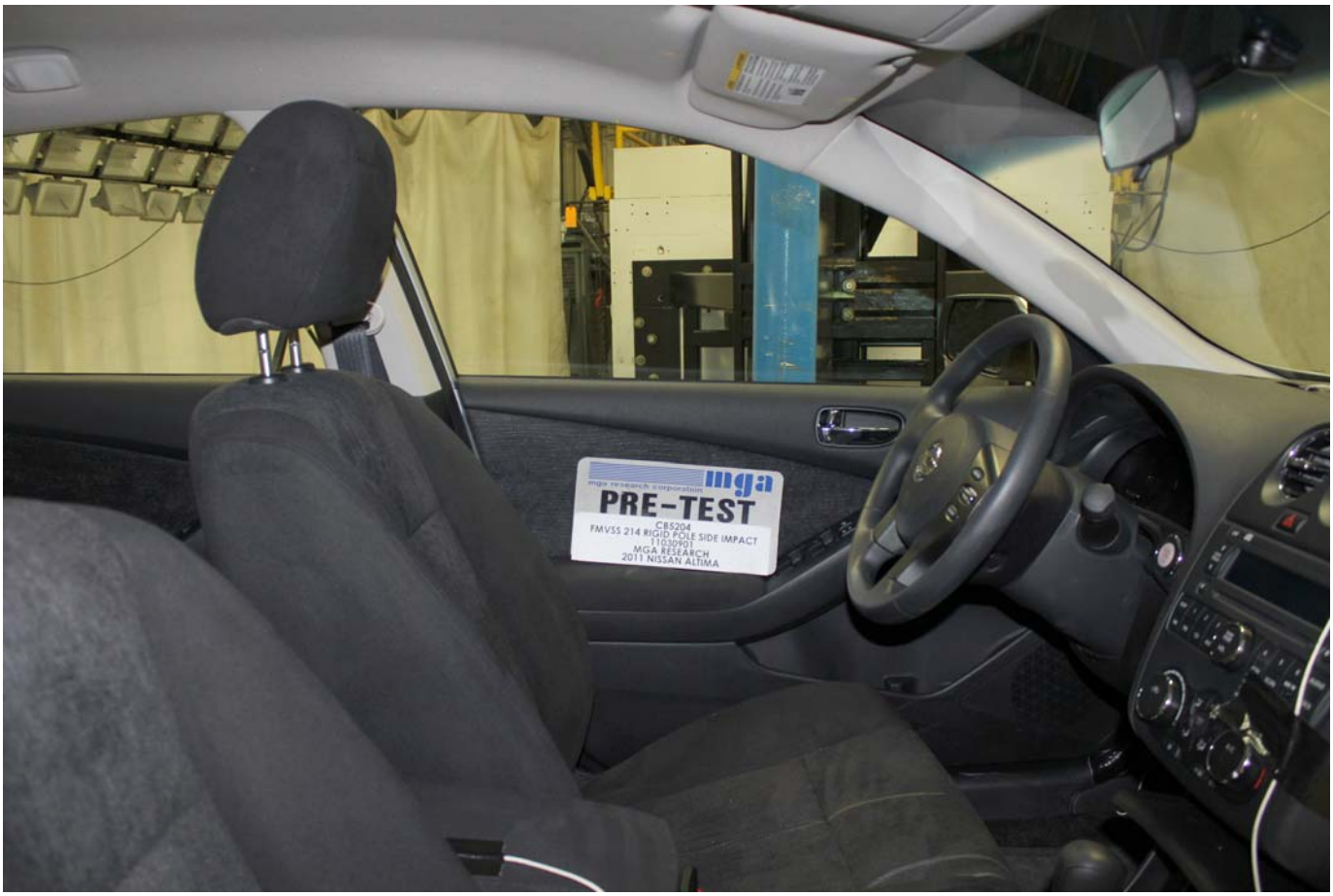
Pre-Test Close-up of Dummy with Door Closed (Impact Side)

Post-Test Dummy with Door Closed (Impact Side)

Pre-Test Dummy Door Open

Pre-Test Dummy Shoulder and Door Top View

Post-Test Dummy Shoulder and Door Top View



Pre-Test Interior of Front Door Closed

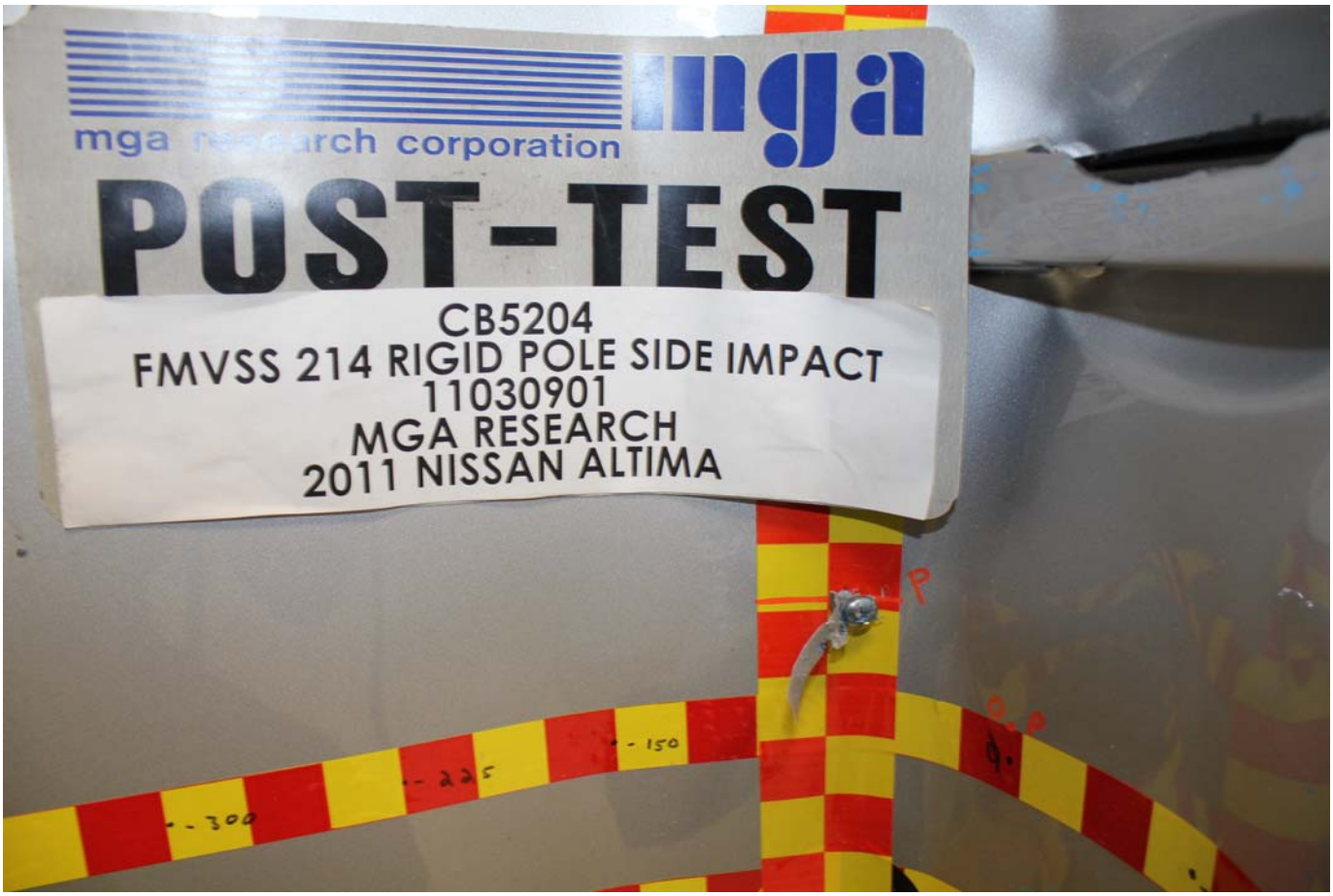
Post-Test Interior of Front Door Showing Dummy Impact Locations

Impact Event

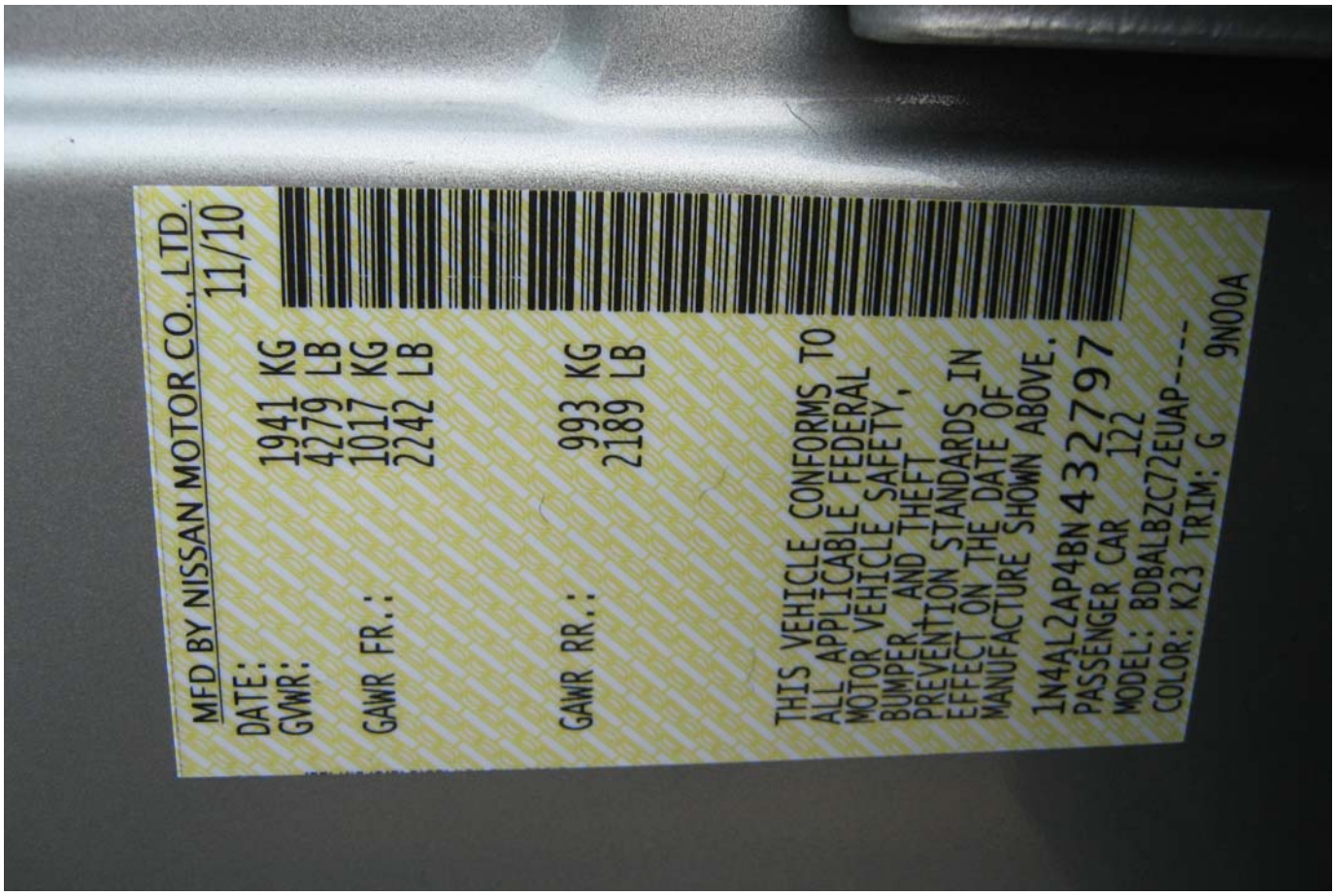
Post-Test Impact Zone Close-up View

Post-Test ¾ Front View of Impact Zone

Post-Test ¾ Rear View of Impact Zone



Post-Test Close-up View of Impact Point Target

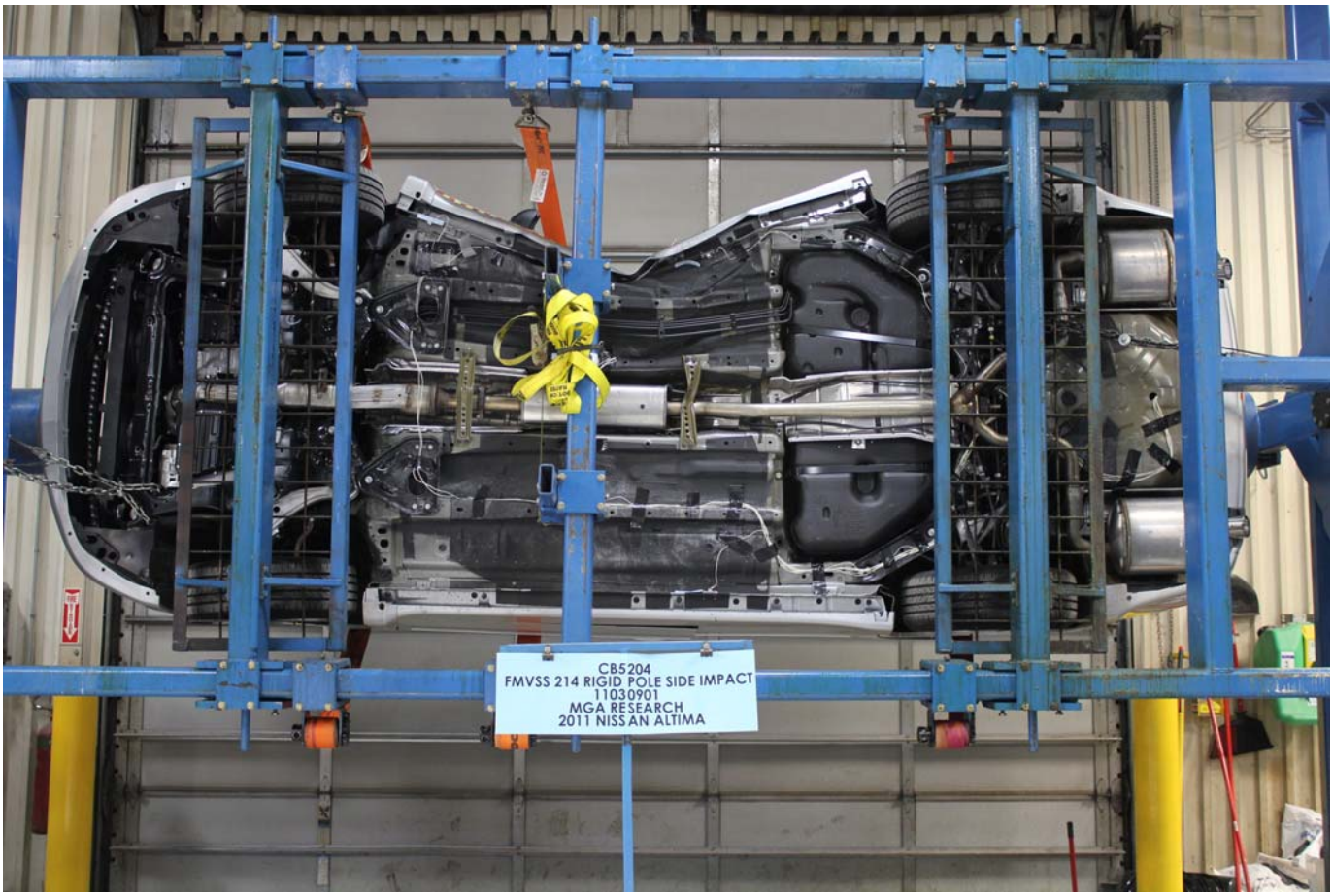


Close-up View of Vehicle's Certification Label

Close-up View of Vehicle's Tire Placard Label

Post-Test Vehicle at 90 Degree Rollover

Post-Test Vehicle at 180 Degree Rollover



Post-Test Vehicle at 270 Degree Rollover

Post-Test Vehicle at 360 Degree Rollover

APPENDIX B

DUMMY RESPONSE DATA

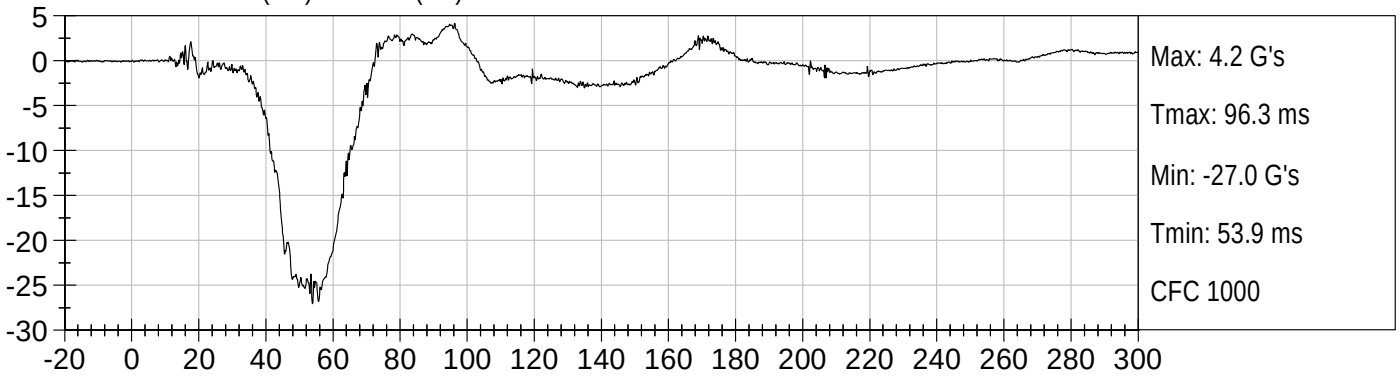
TABLE OF DATA PLOTS

Dummy Instrumentation Plots
FILTERED DATA

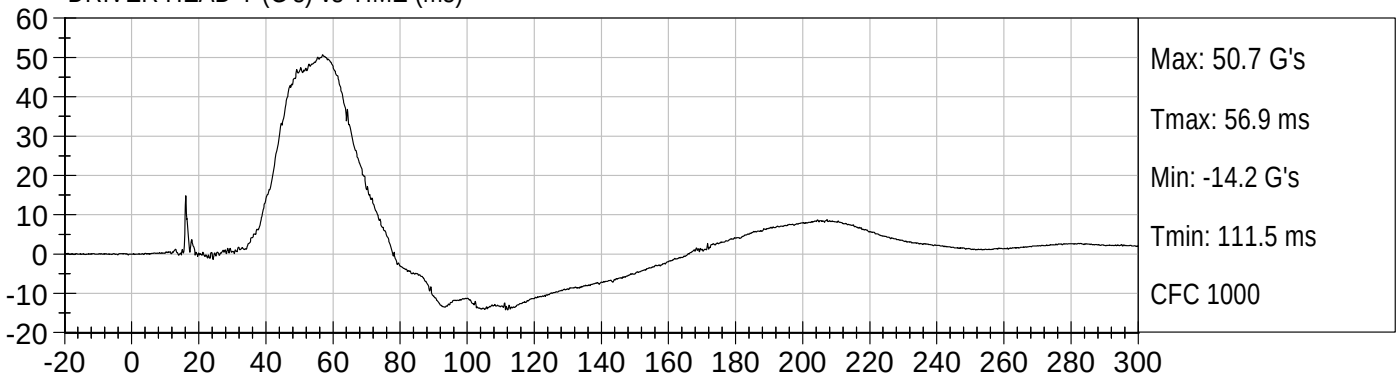
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

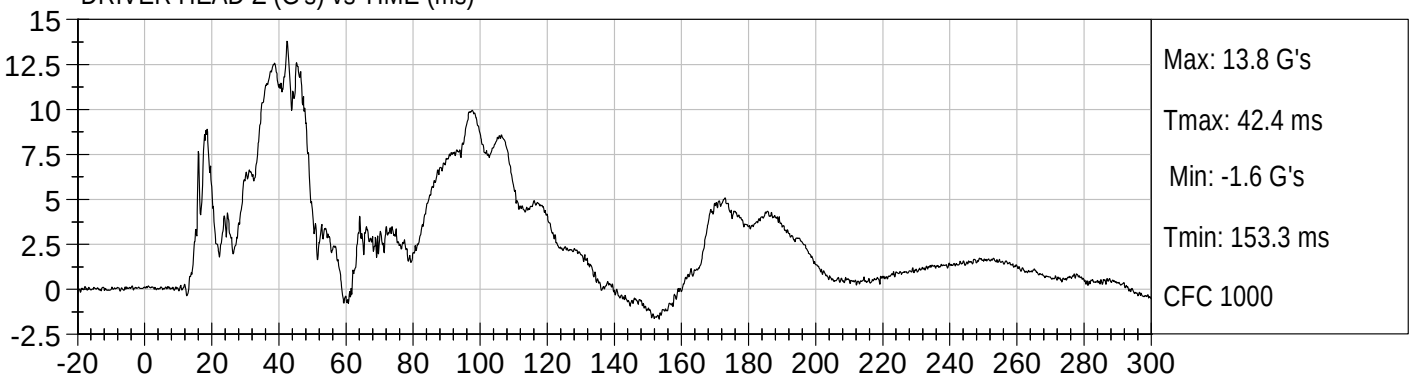
DRIVER HEAD X (G's) vs TIME (ms)



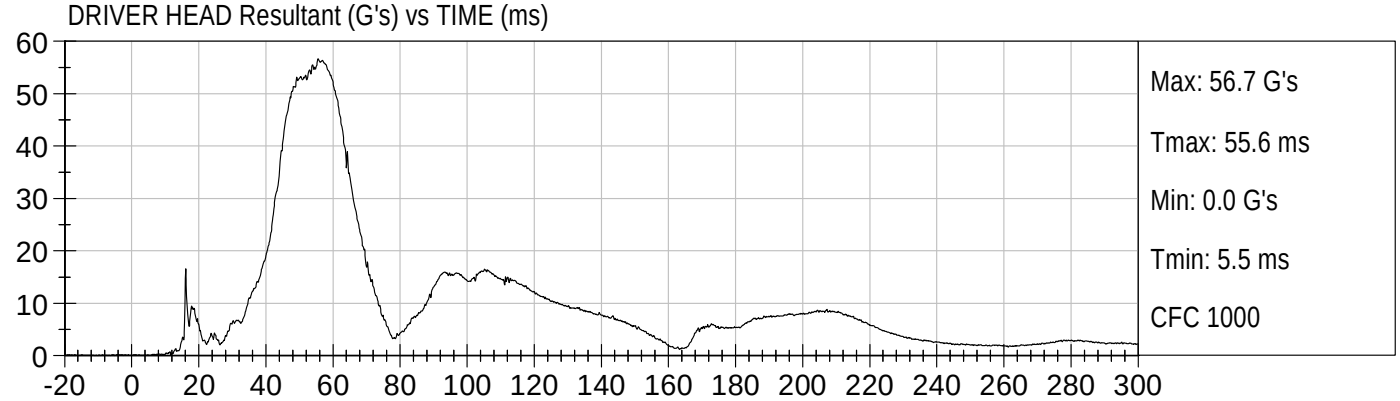
DRIVER HEAD Y (G's) vs TIME (ms)



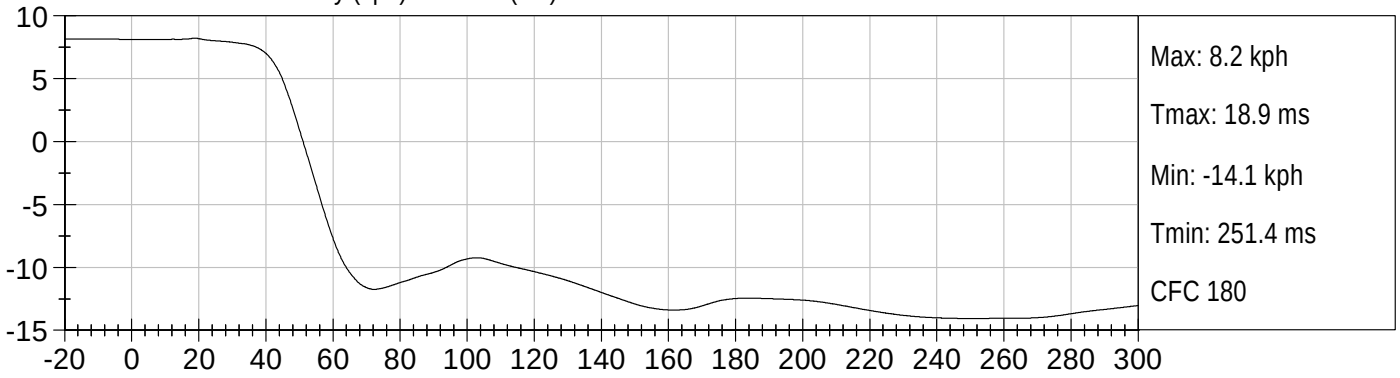
DRIVER HEAD Z (G's) vs TIME (ms)



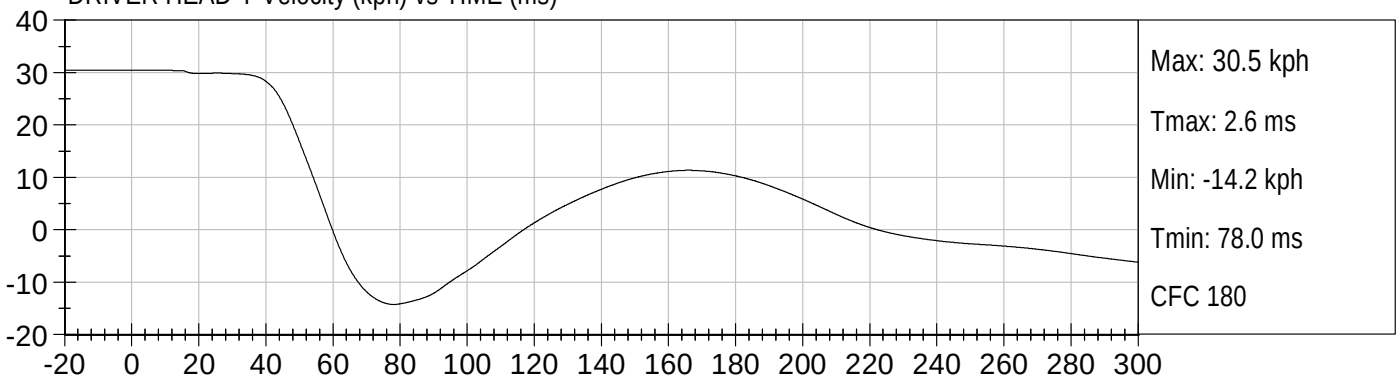
DRIVER HEAD Resultant (G's) vs TIME (ms)



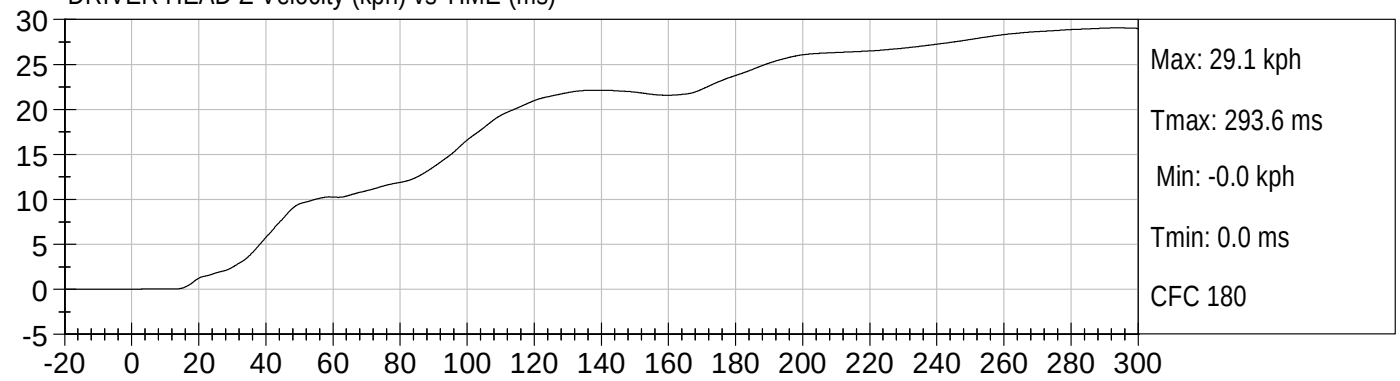
DRIVER HEAD X Velocity (kph) vs TIME (ms)



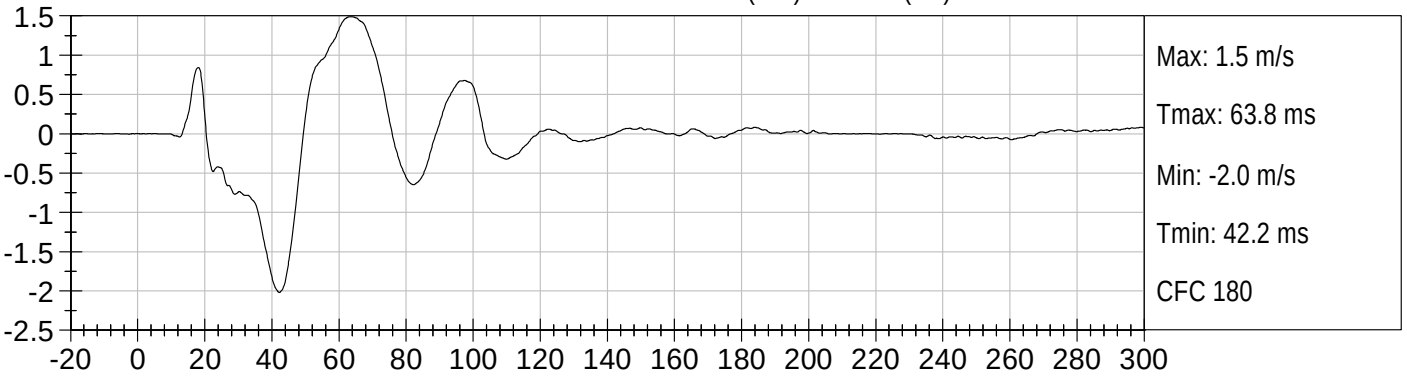
DRIVER HEAD Y Velocity (kph) vs TIME (ms)



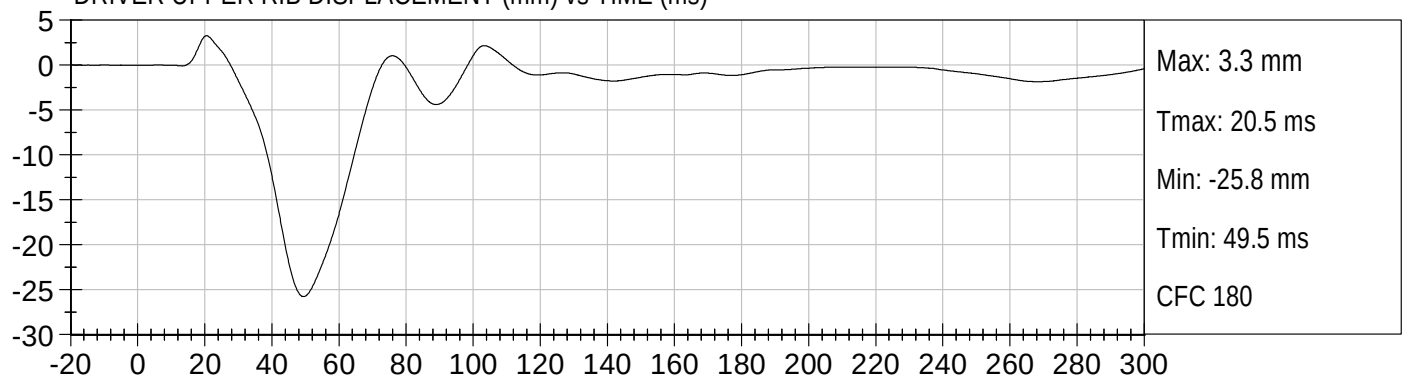
DRIVER HEAD Z Velocity (kph) vs TIME (ms)



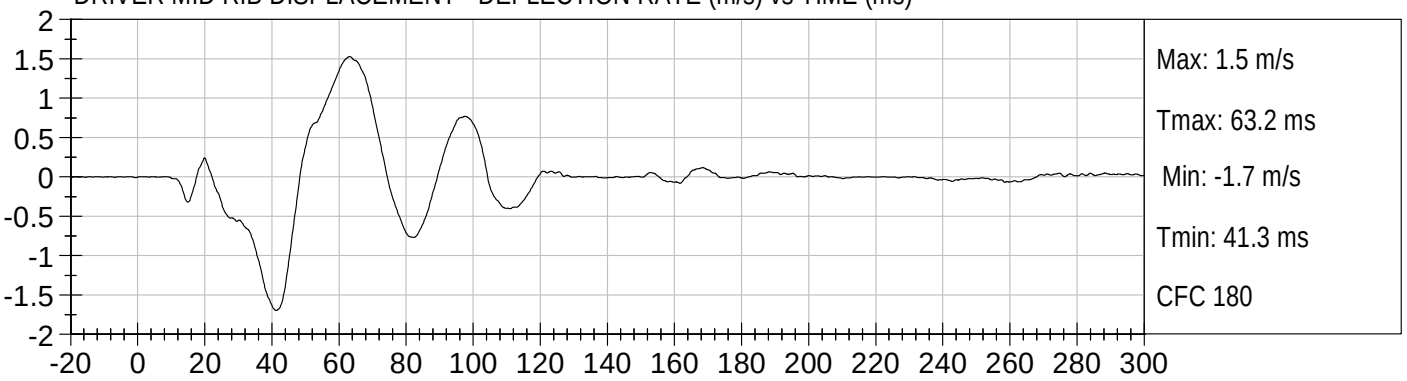
DRIVER UPPER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



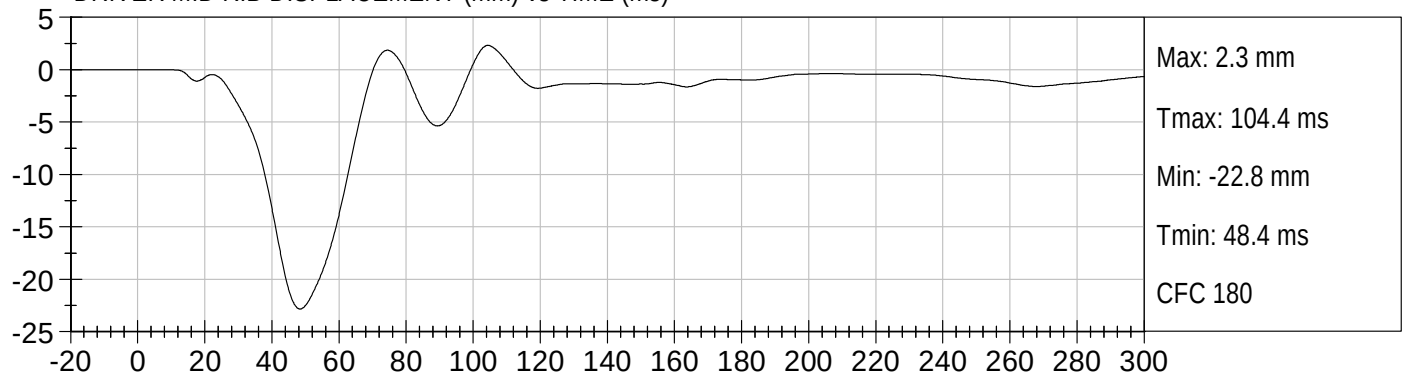
DRIVER UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



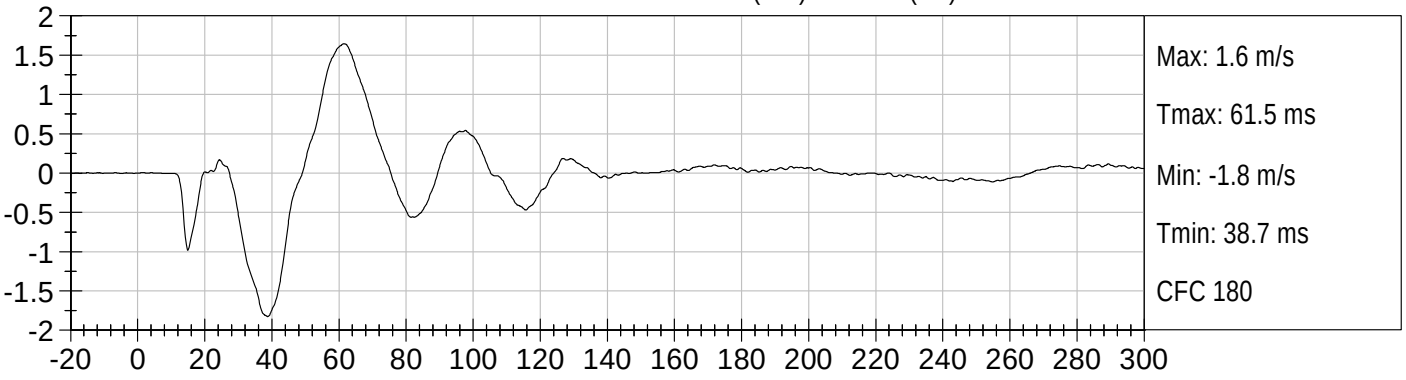
DRIVER MID RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)



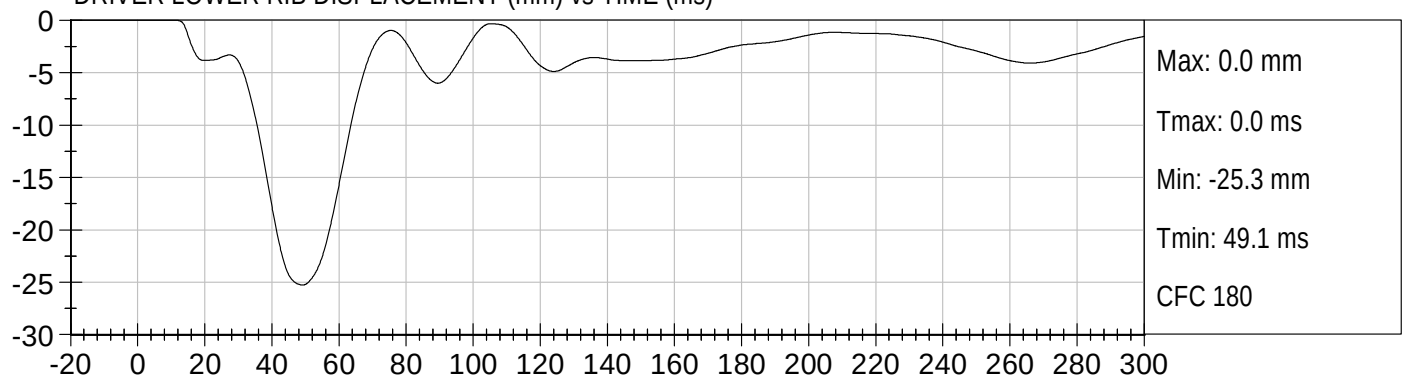
DRIVER MID RIB DISPLACEMENT (mm) vs TIME (ms)



DRIVER LOWER RIB DISPLACEMENT - DEFLECTION RATE (m/s) vs TIME (ms)

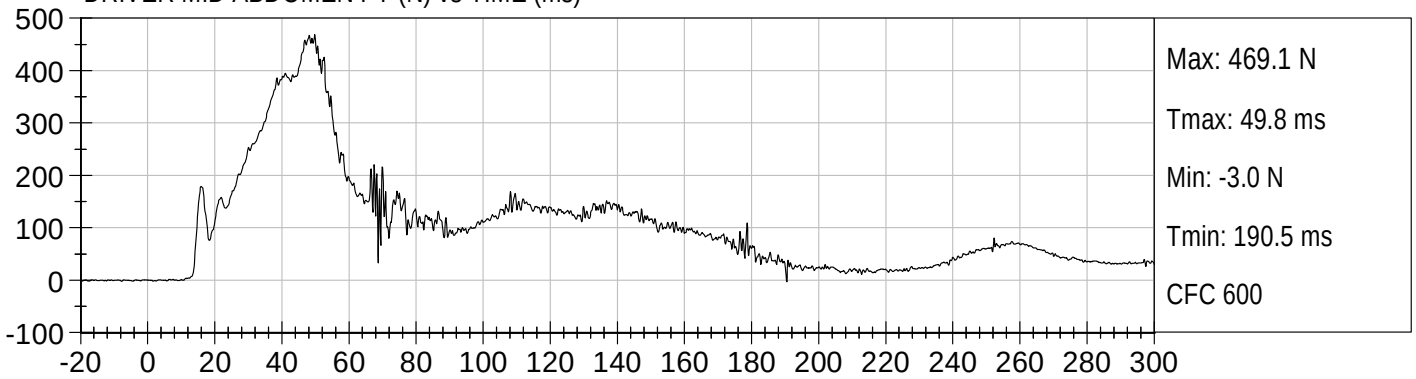


DRIVER LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

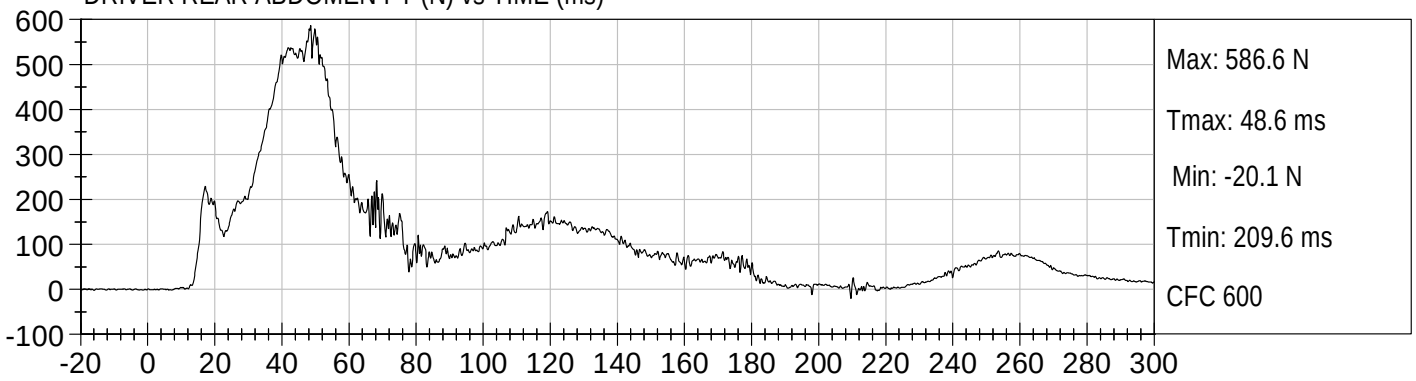


DRIVER FRONT ABDOMEN FY (N) vs TIME (ms)

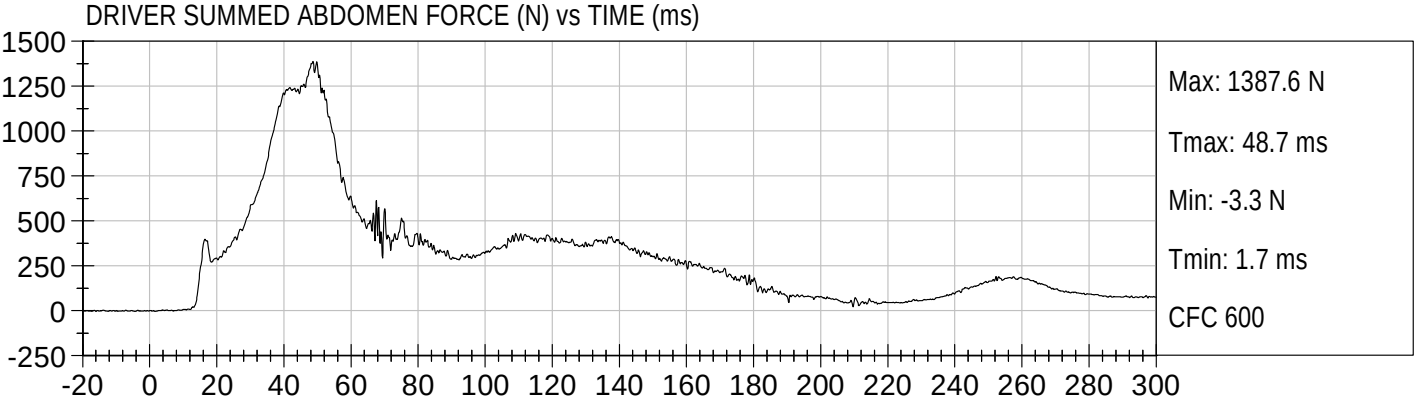
DRIVER MID ABDOMEN FY (N) vs TIME (ms)



DRIVER REAR ABDOMEN FY (N) vs TIME (ms)

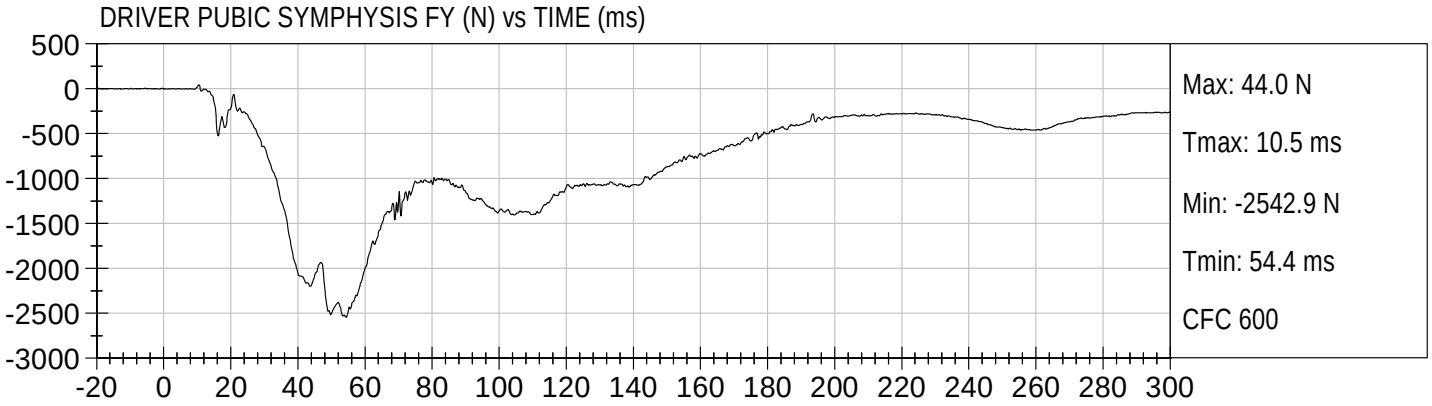


DRIVER SUMMED ABDOMEN FORCE (N) vs TIME (ms)



FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)



APPENDIX C

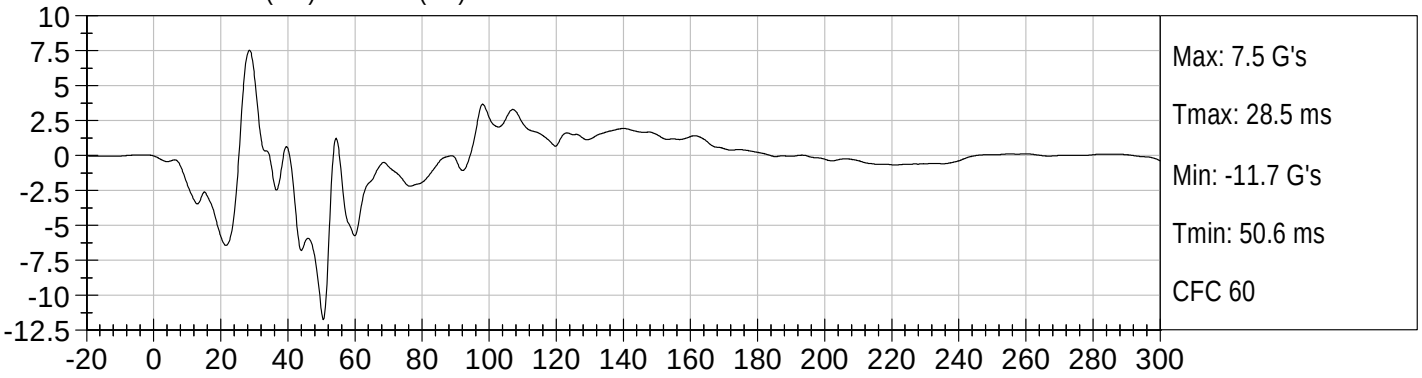
VEHICLE ACCELEROMETER RESPONSE DATA

TABLE OF DATA PLOTS

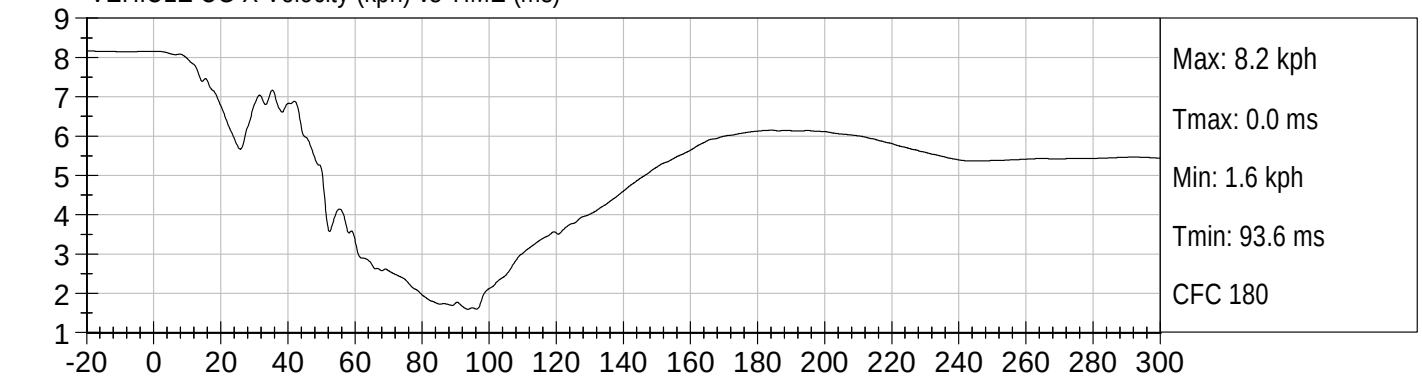
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

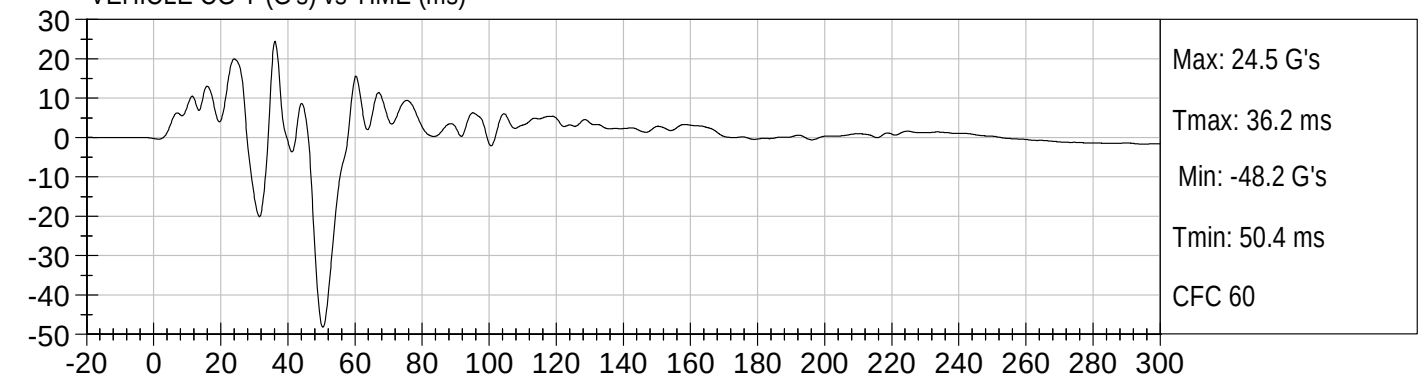
VEHICLE CG X (G's) vs TIME (ms)



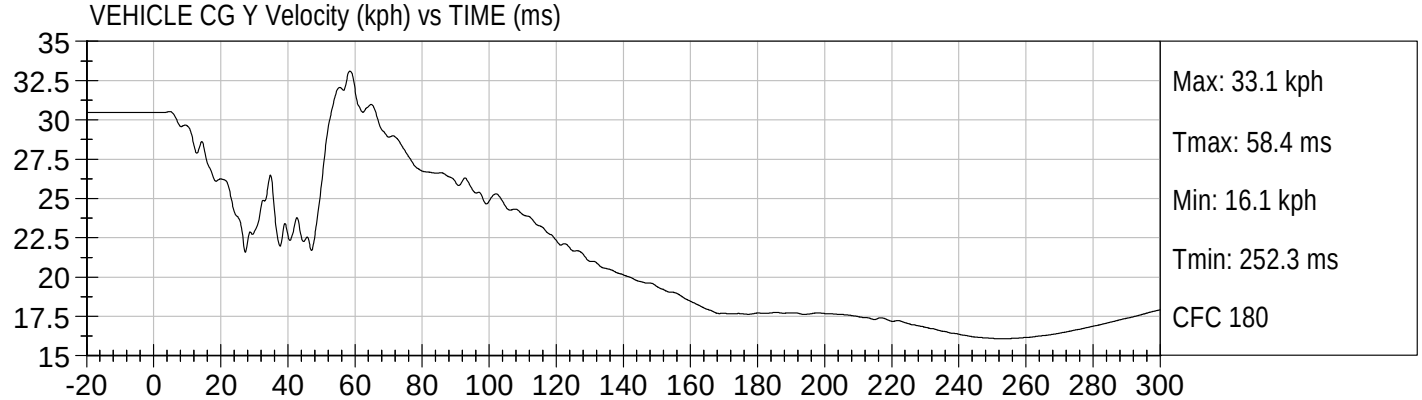
VEHICLE CG X Velocity (kph) vs TIME (ms)



VEHICLE CG Y (G's) vs TIME (ms)



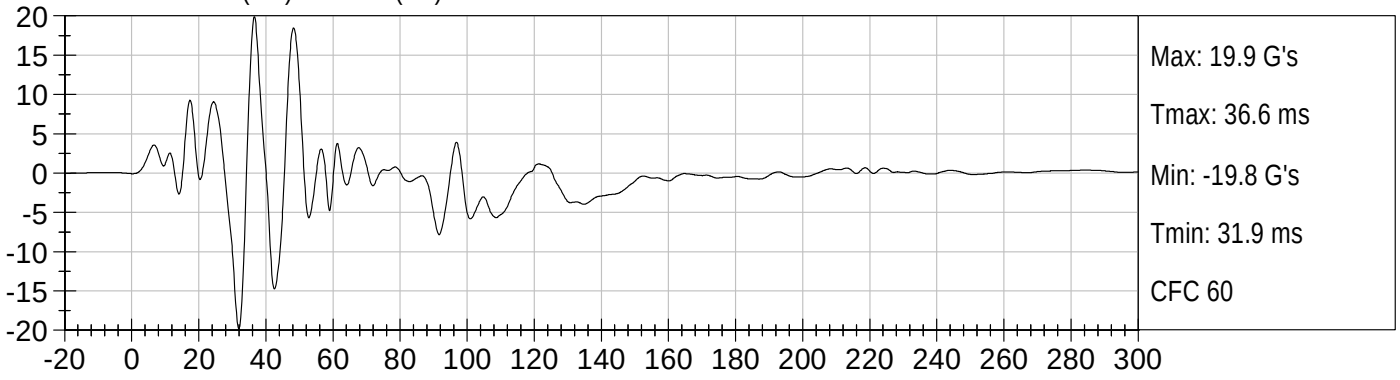
VEHICLE CG Y Velocity (kph) vs TIME (ms)



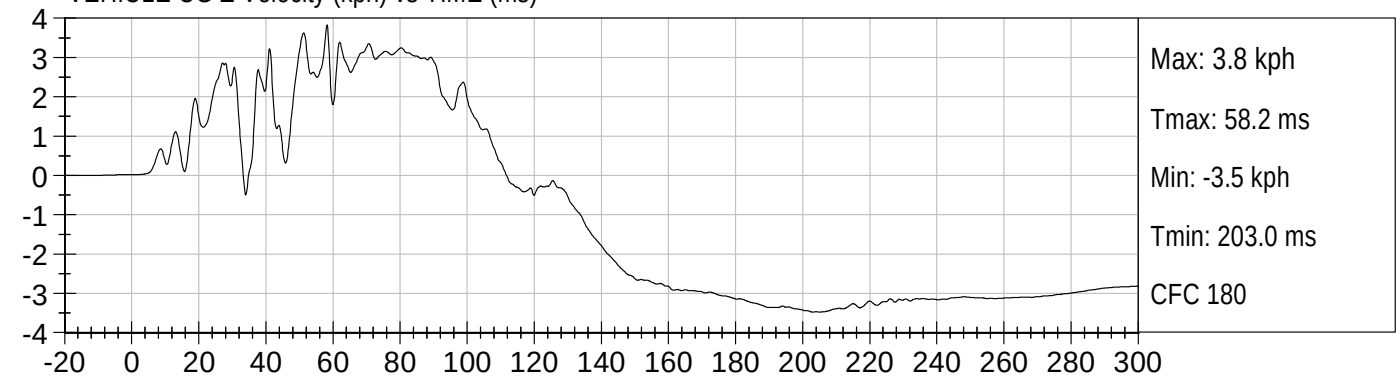
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

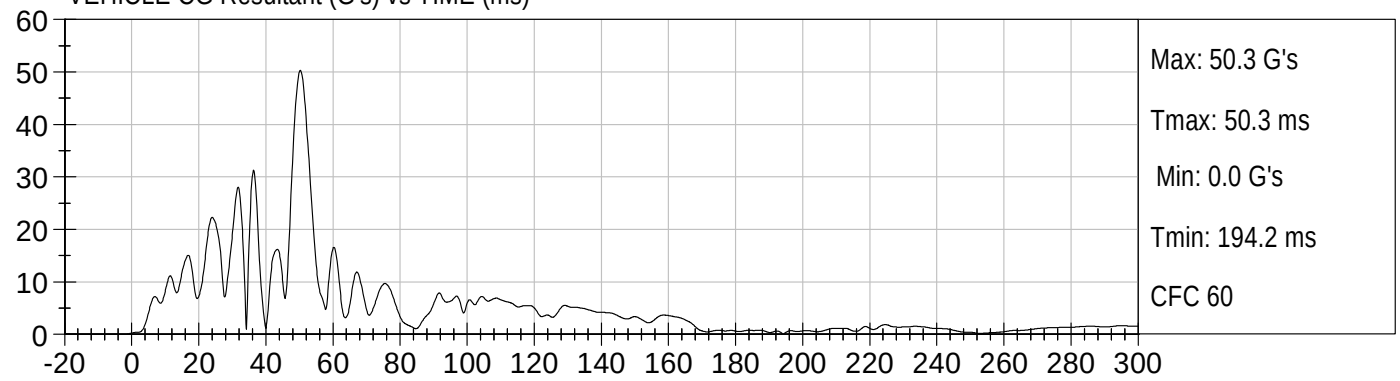
VEHICLE CG Z (G's) vs TIME (ms)



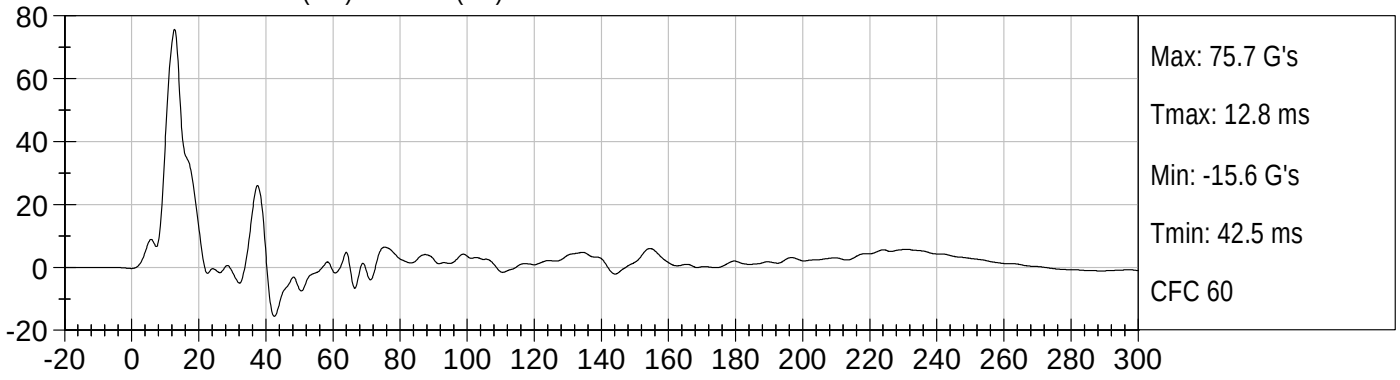
VEHICLE CG Z Velocity (kph) vs TIME (ms)



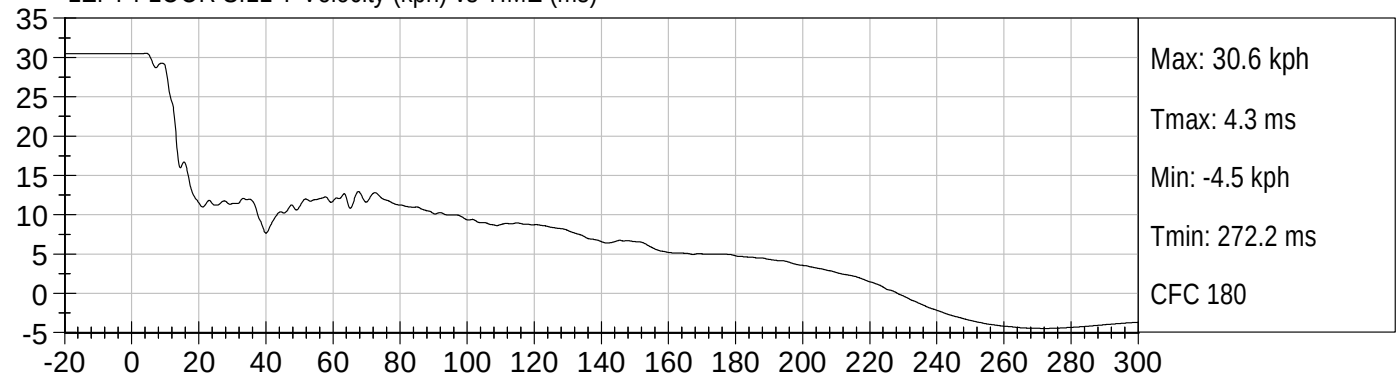
VEHICLE CG Resultant (G's) vs TIME (ms)



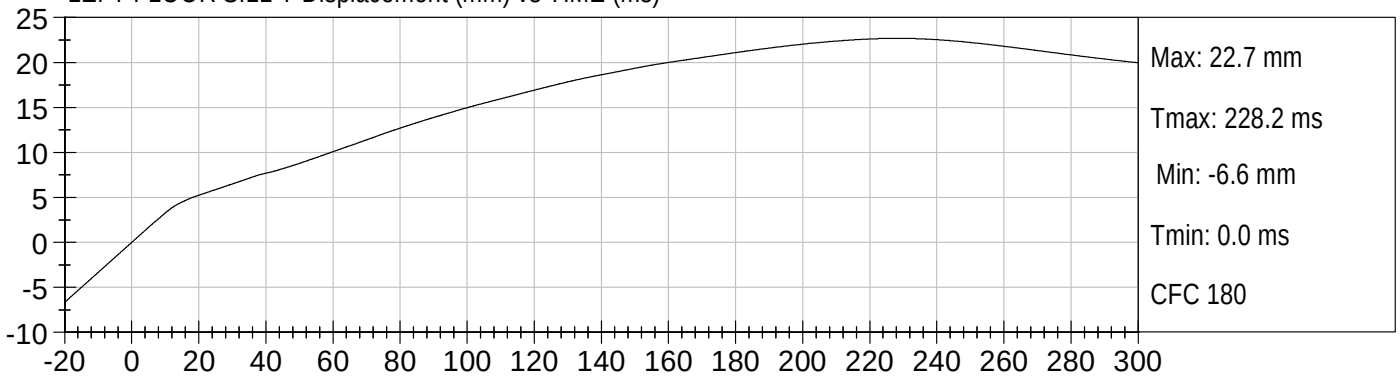
LEFT FLOOR SILL Y (G's) vs TIME (ms)



LEFT FLOOR SILL Y Velocity (kph) vs TIME (ms)



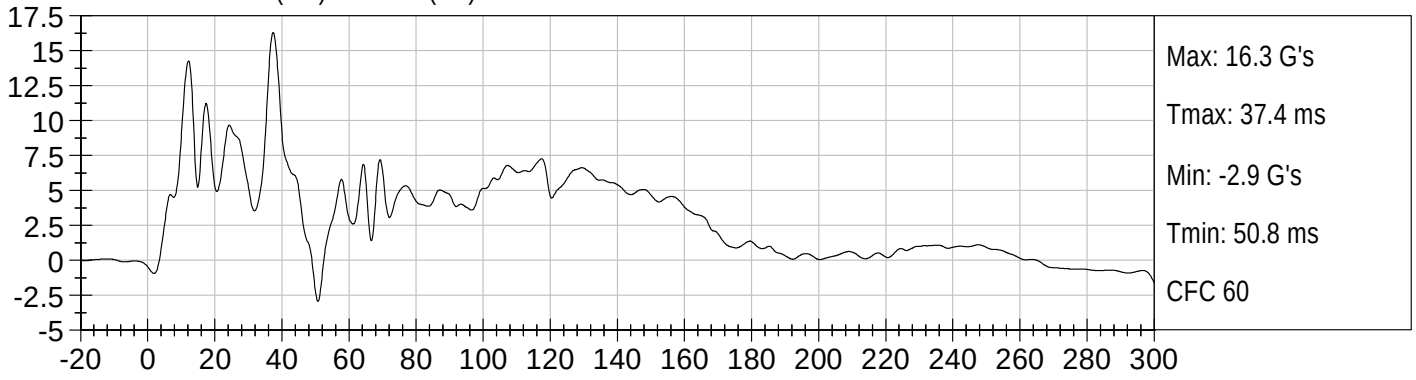
LEFT FLOOR SILL Y Displacement (mm) vs TIME (ms)



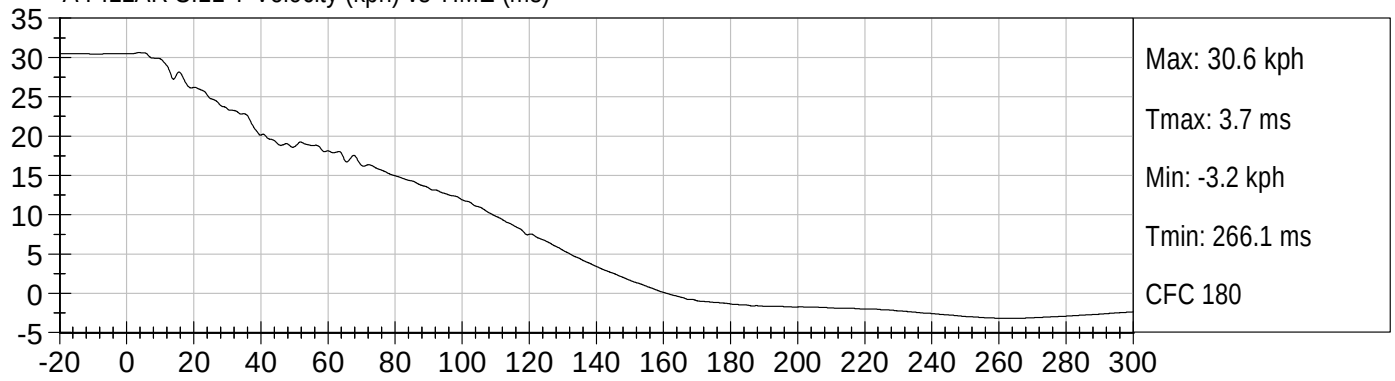
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

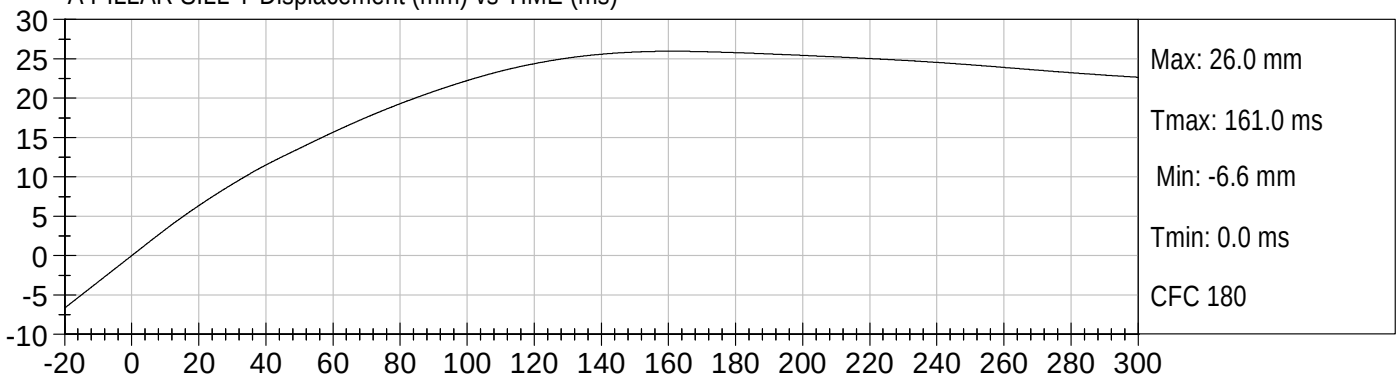
A PILLAR SILL Y (G's) vs TIME (ms)



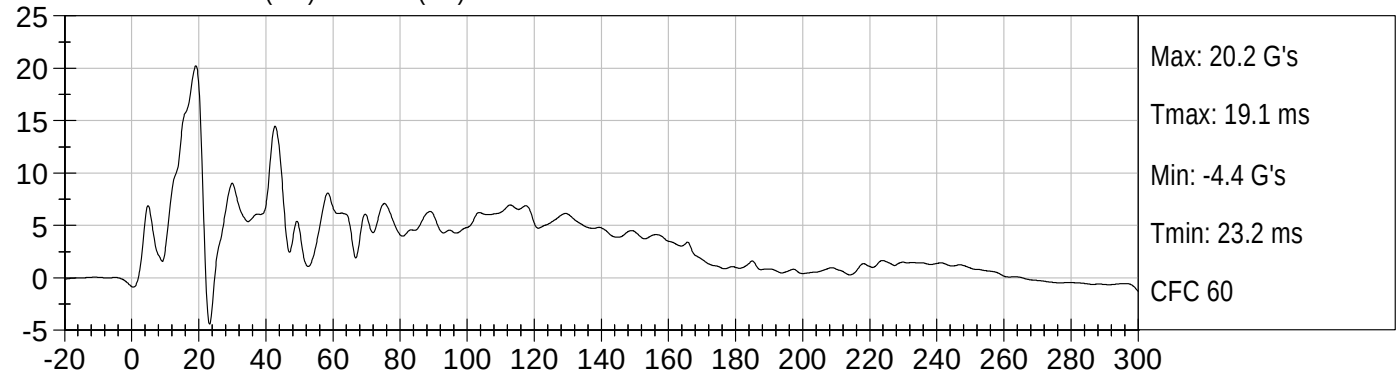
A PILLAR SILL Y Velocity (kph) vs TIME (ms)



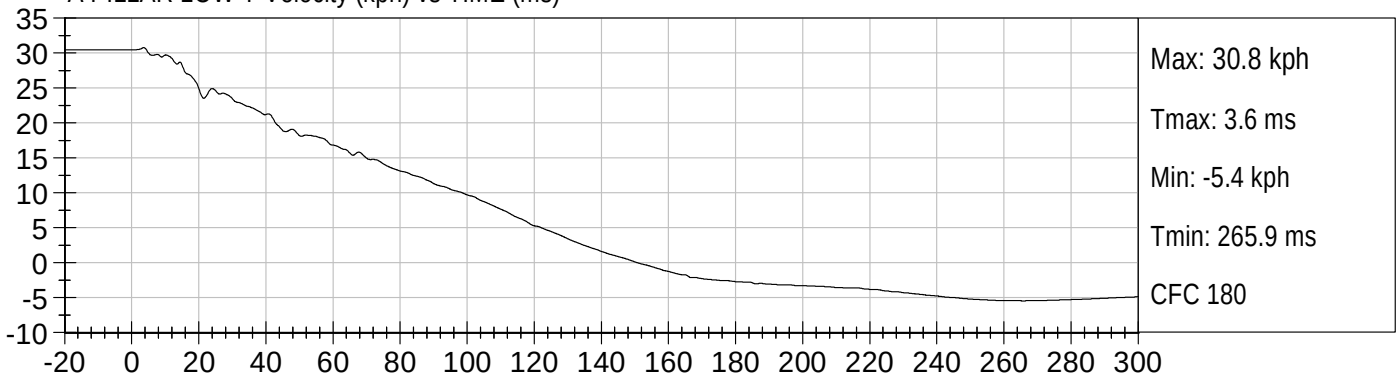
A PILLAR SILL Y Displacement (mm) vs TIME (ms)



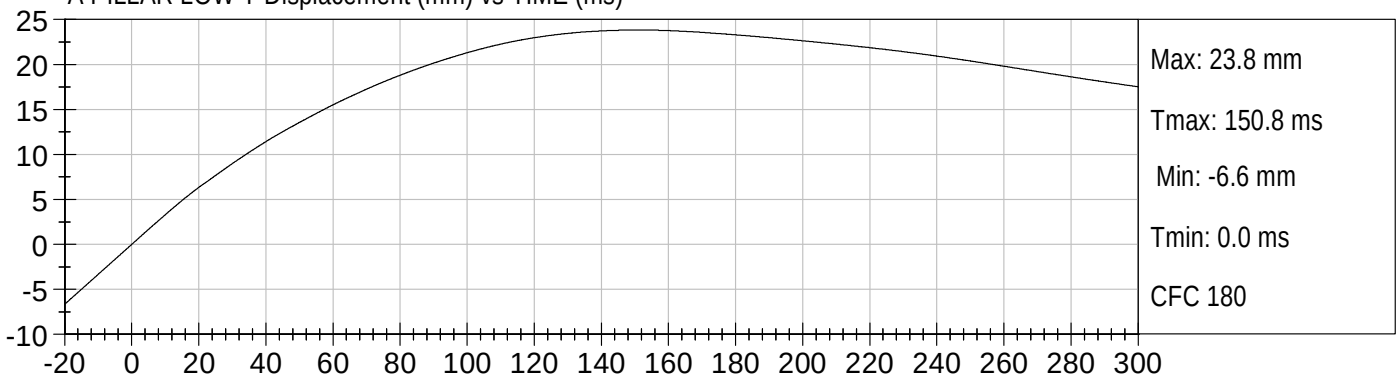
A PILLAR LOW Y (G's) vs TIME (ms)



A PILLAR LOW Y Velocity (kph) vs TIME (ms)



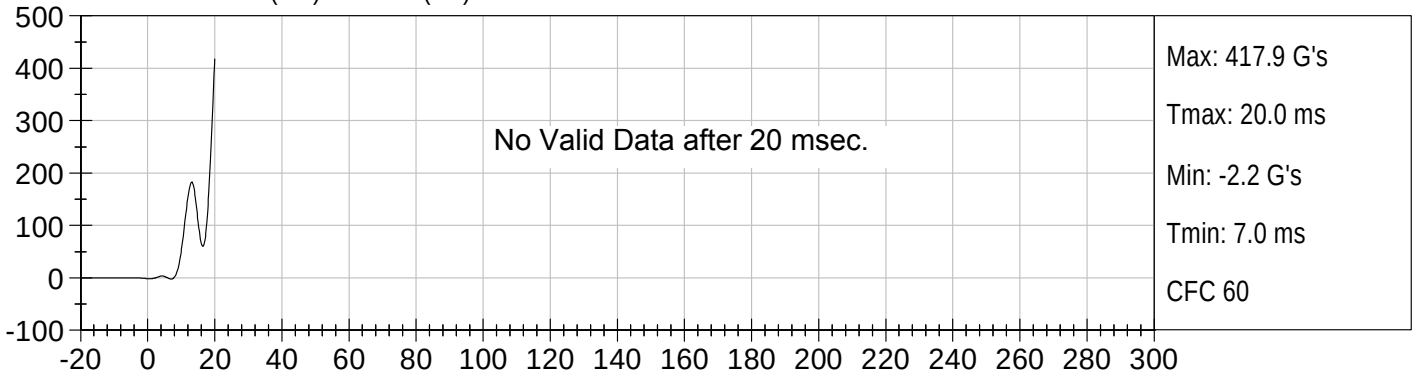
A PILLAR LOW Y Displacement (mm) vs TIME (ms)



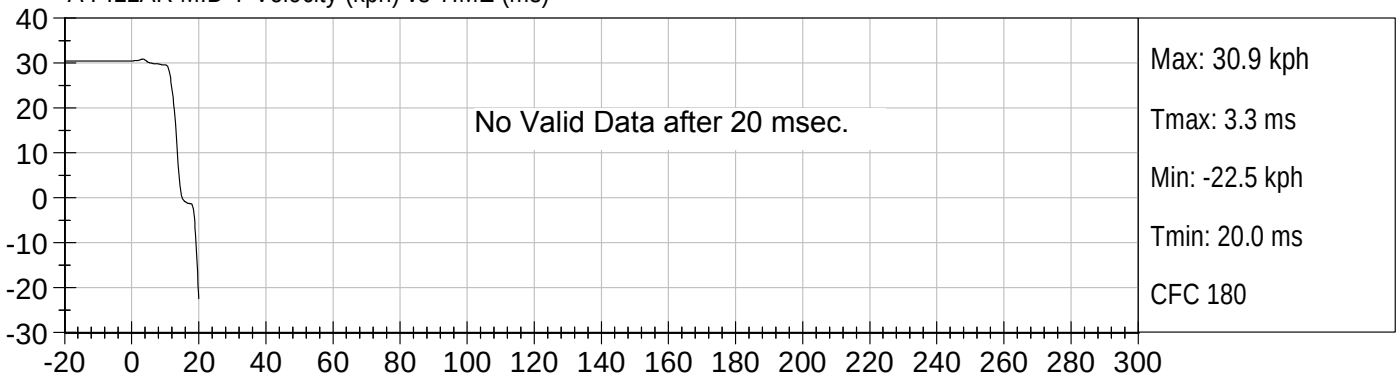
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

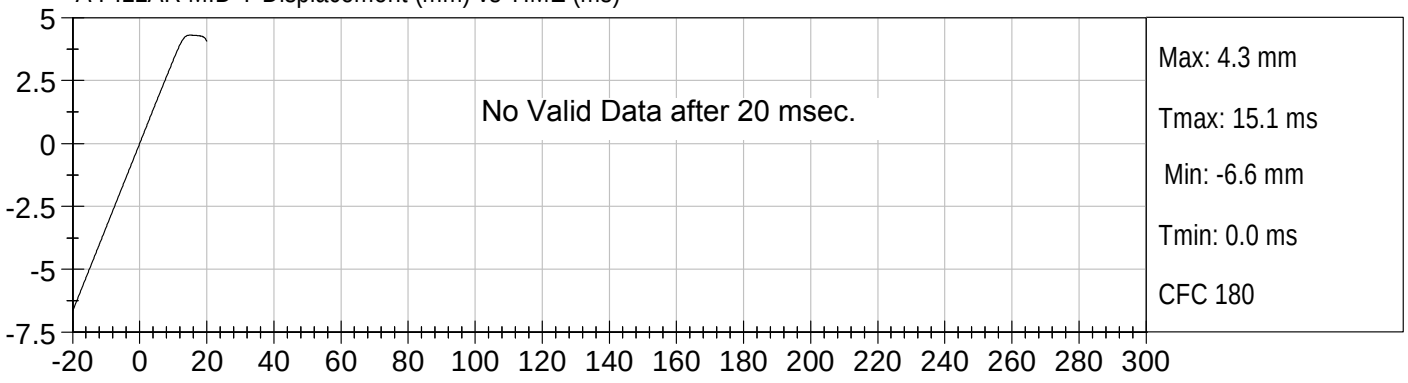
A PILLAR MID Y (G's) vs TIME (ms)



A PILLAR MID Y Velocity (kph) vs TIME (ms)



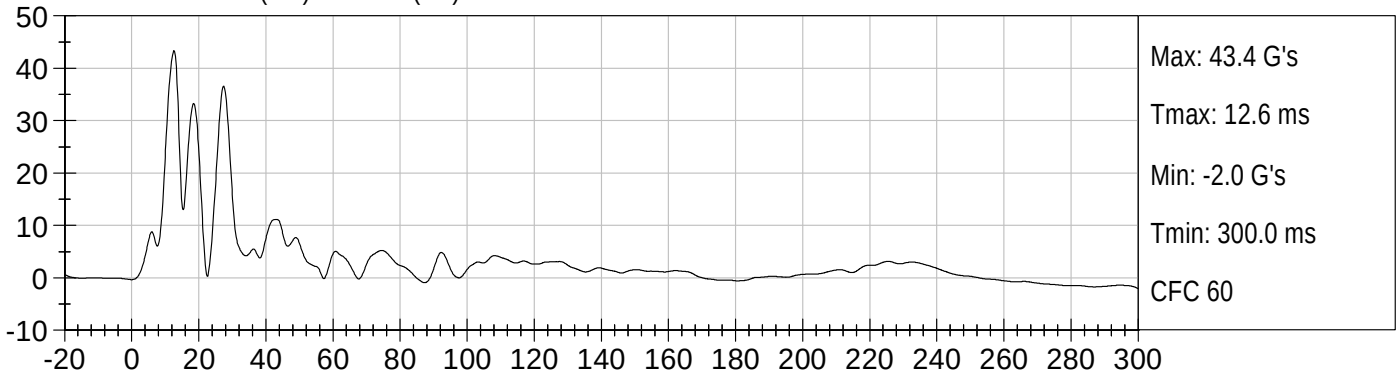
A PILLAR MID Y Displacement (mm) vs TIME (ms)



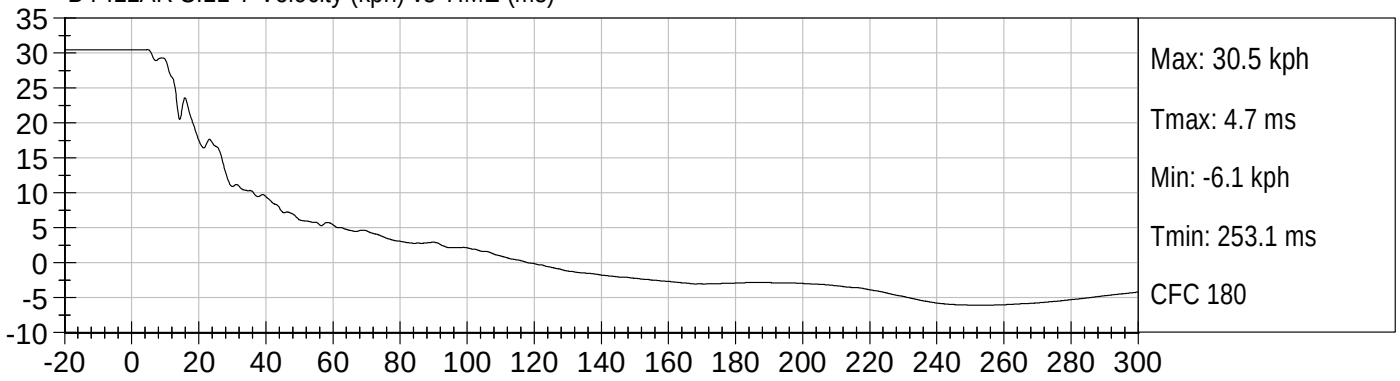
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

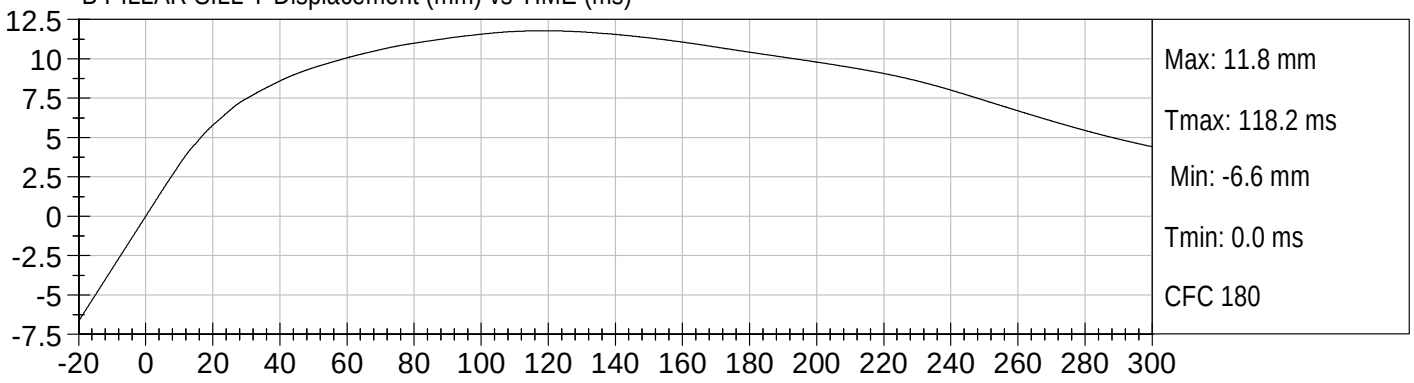
B PILLAR SILL Y (G's) vs TIME (ms)



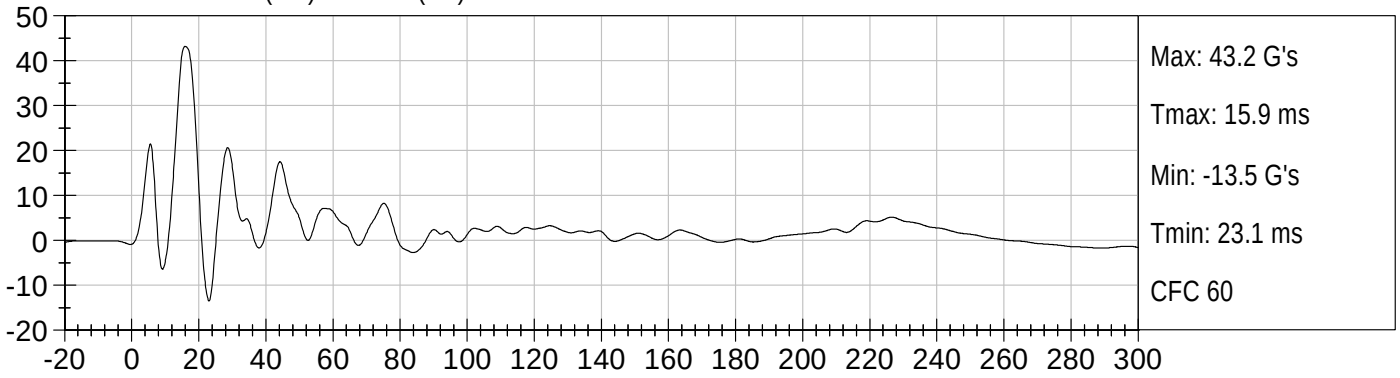
B PILLAR SILL Y Velocity (kph) vs TIME (ms)



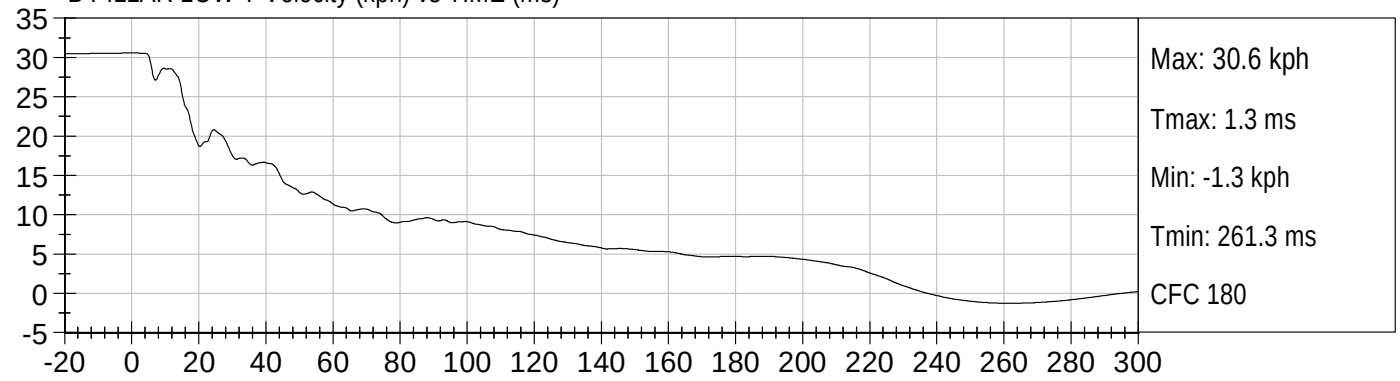
B PILLAR SILL Y Displacement (mm) vs TIME (ms)



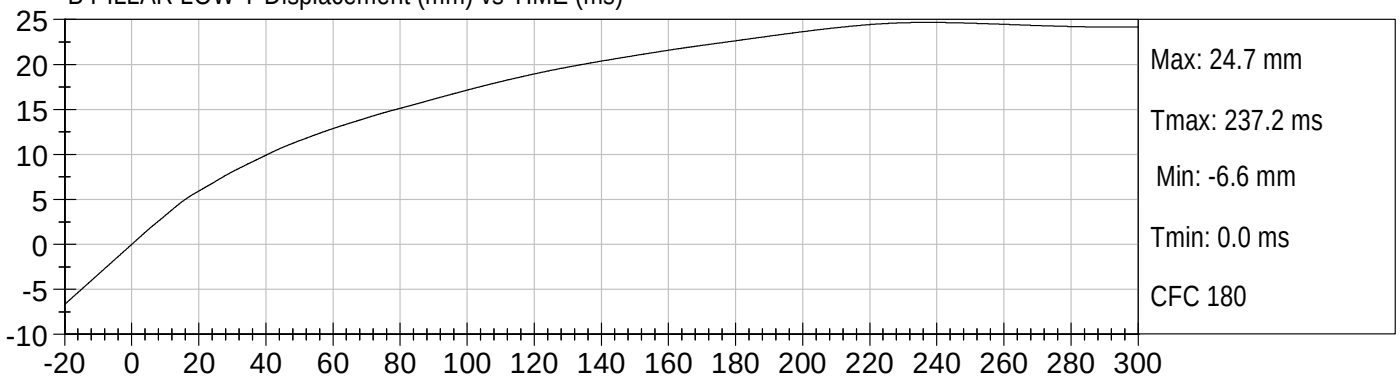
B PILLAR LOW Y (G's) vs TIME (ms)



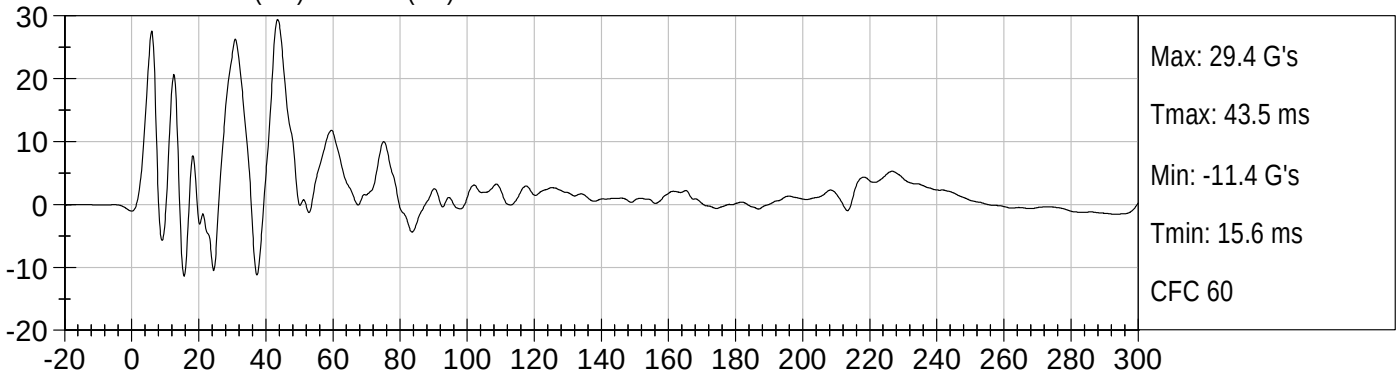
B PILLAR LOW Y Velocity (kph) vs TIME (ms)



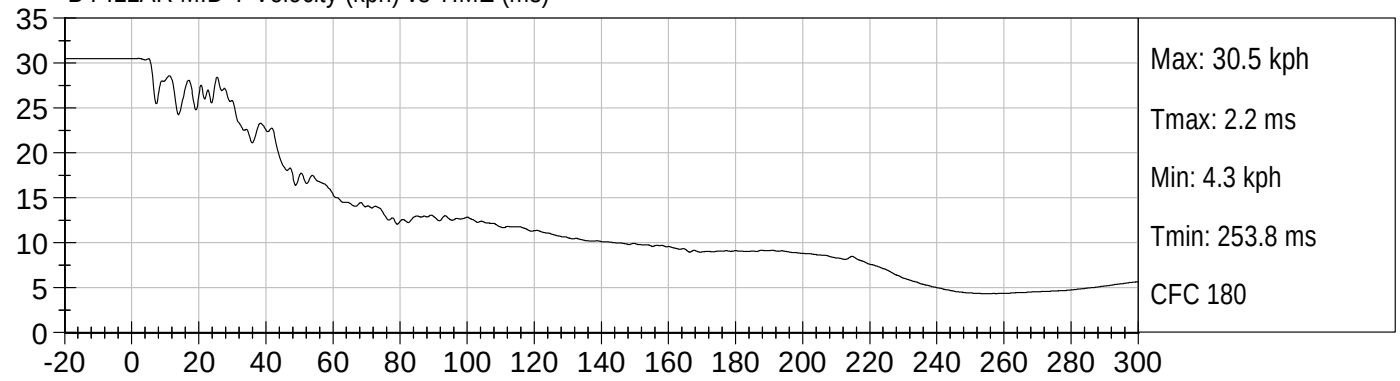
B PILLAR LOW Y Displacement (mm) vs TIME (ms)



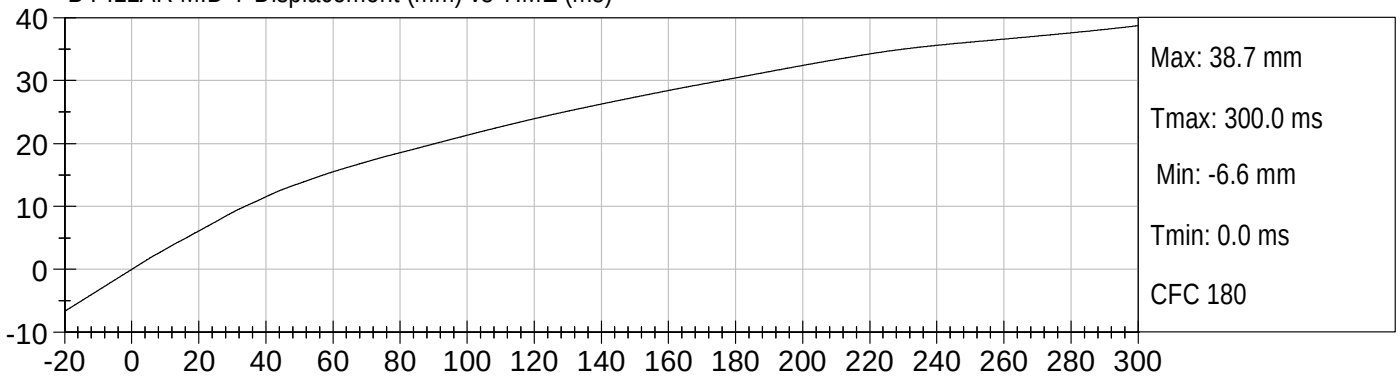
B PILLAR MID Y (G's) vs TIME (ms)



B PILLAR MID Y Velocity (kph) vs TIME (ms)



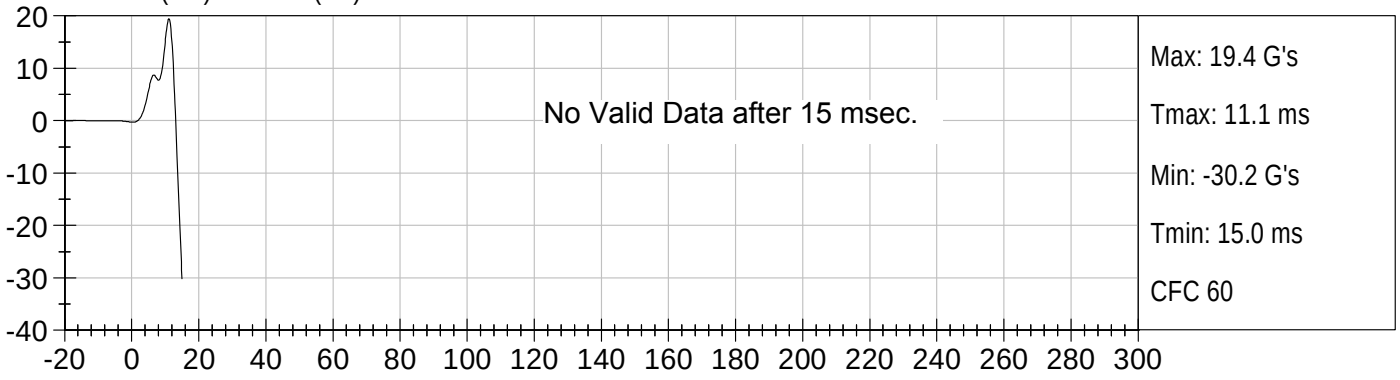
B PILLAR MID Y Displacement (mm) vs TIME (ms)



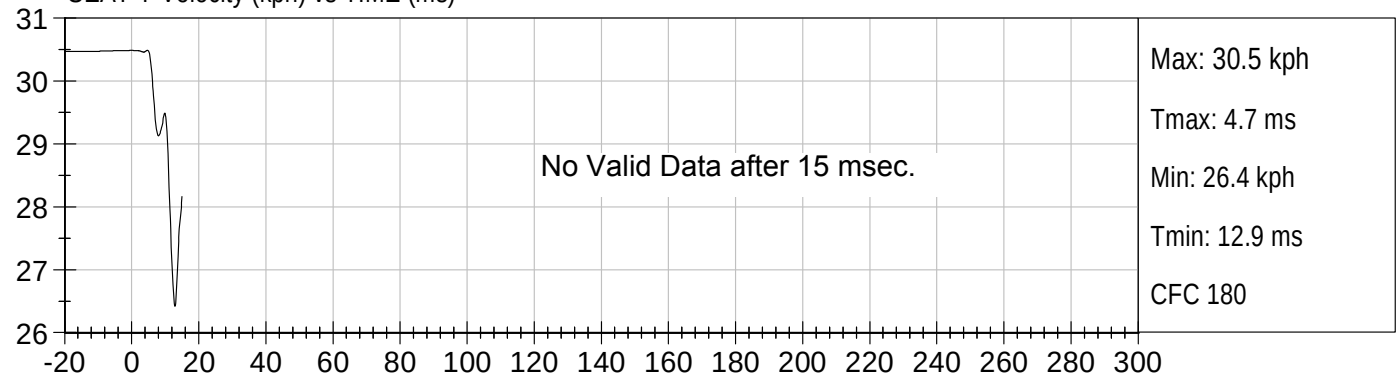
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

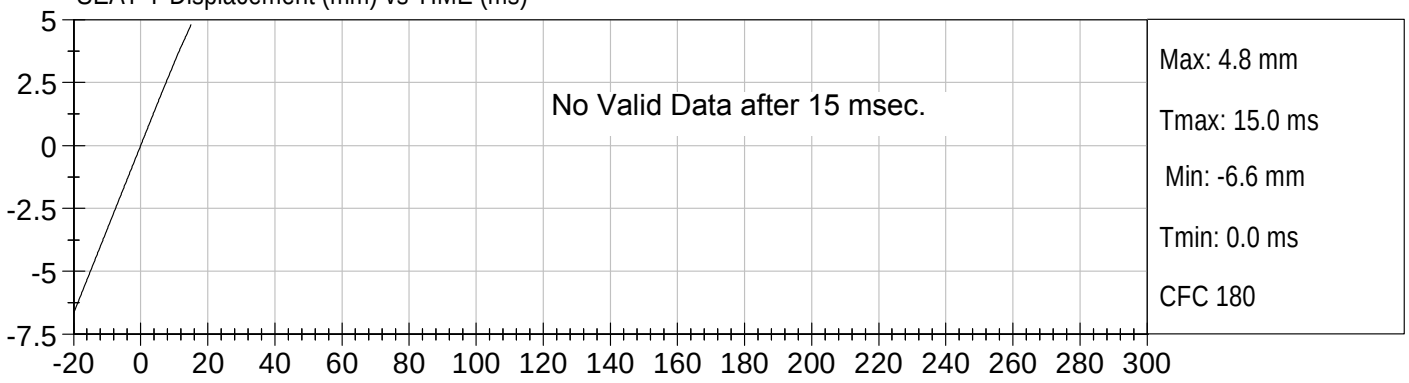
SEAT Y (G's) vs TIME (ms)



SEAT Y Velocity (kph) vs TIME (ms)



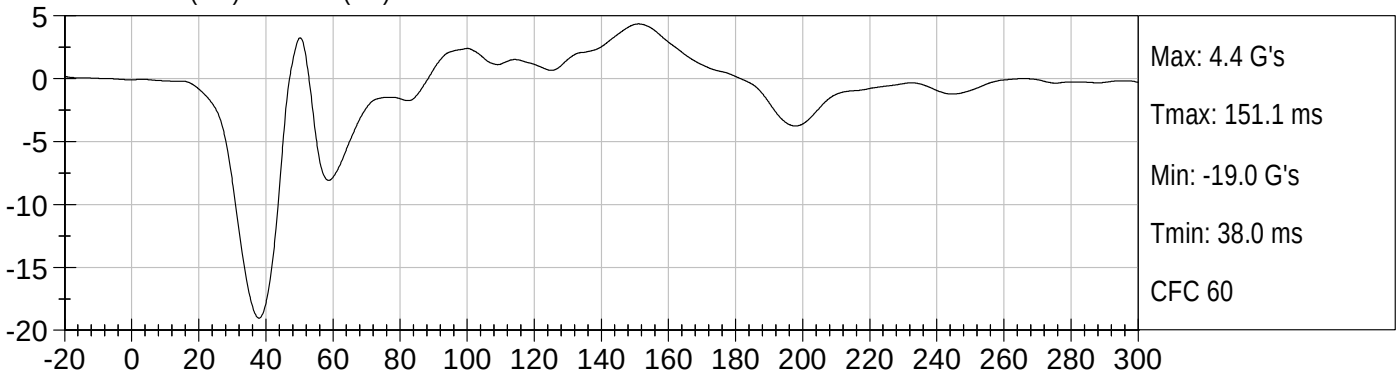
SEAT Y Displacement (mm) vs TIME (ms)



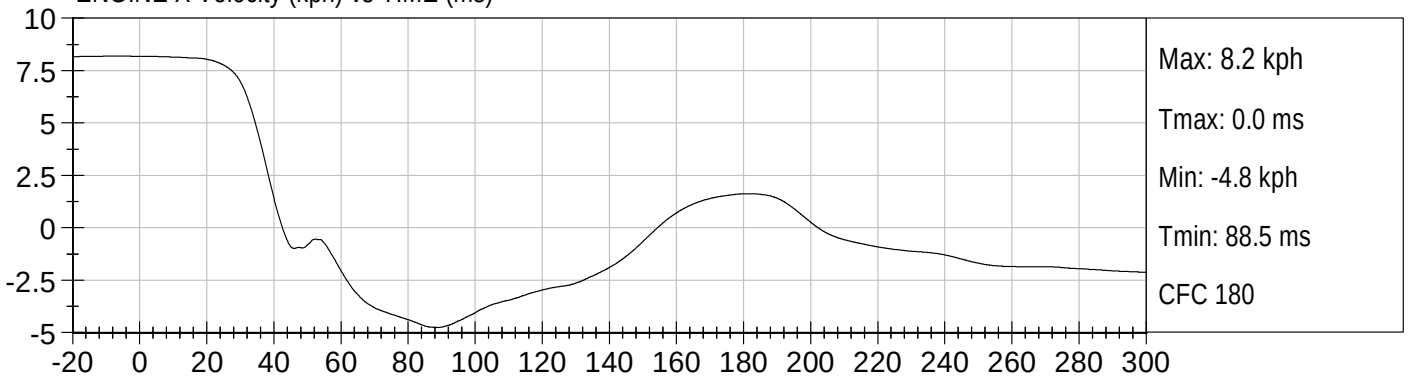
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

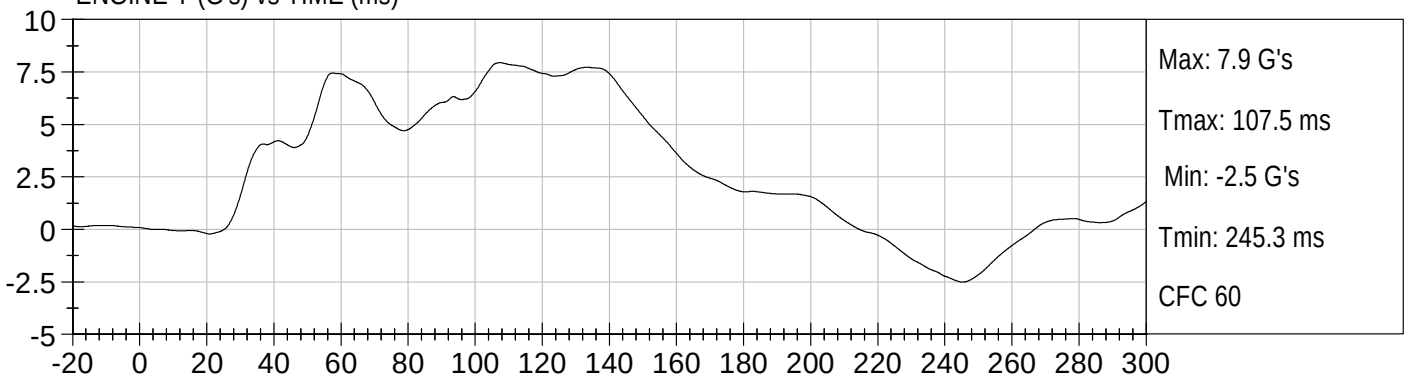
ENGINE X (G's) vs TIME (ms)



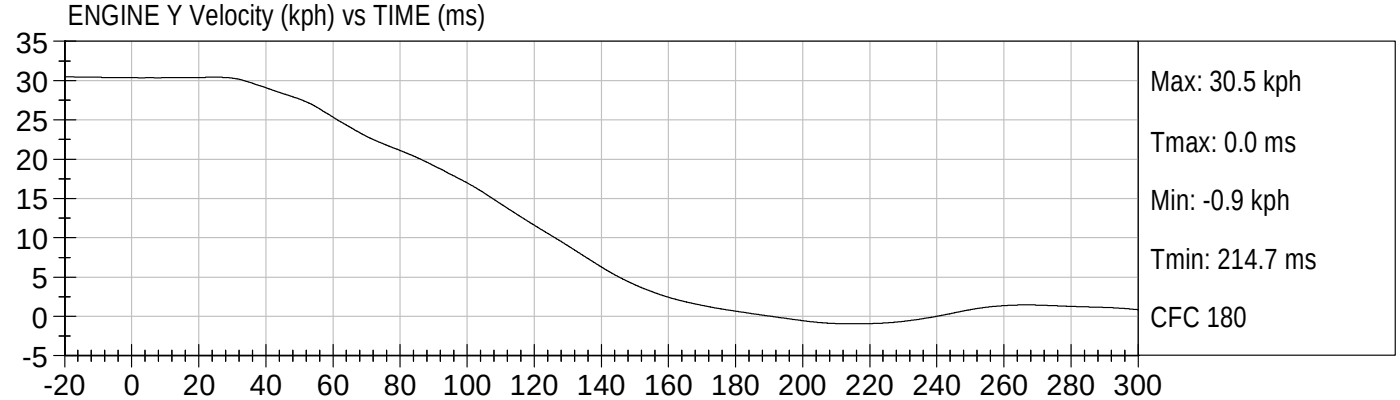
ENGINE X Velocity (kph) vs TIME (ms)

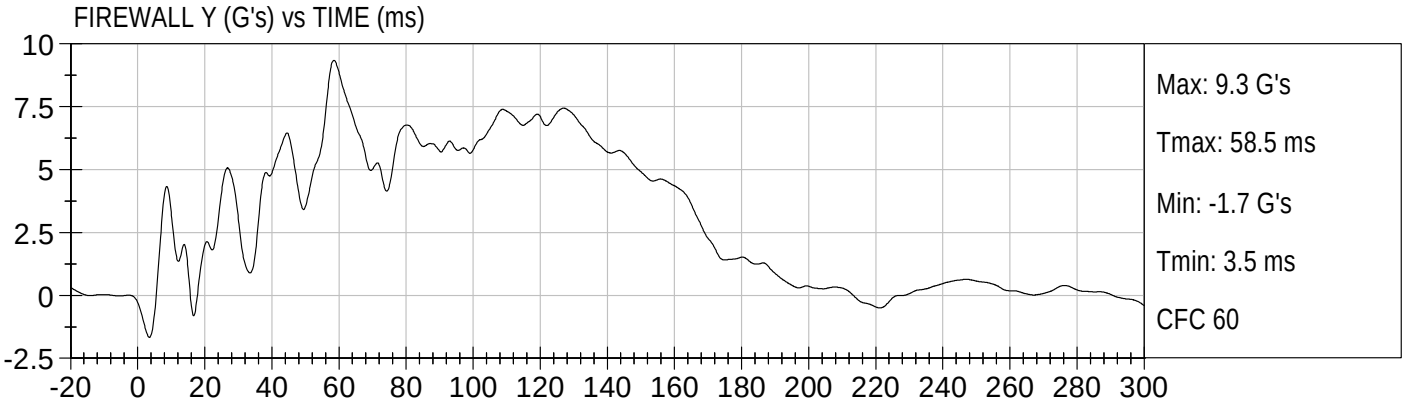


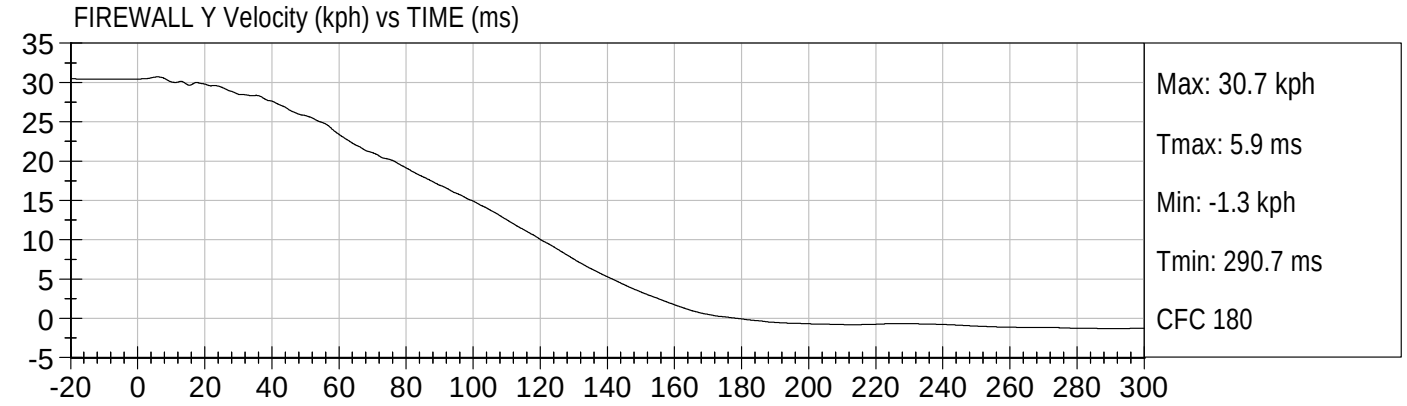
ENGINE Y (G's) vs TIME (ms)



ENGINE Y Velocity (kph) vs TIME (ms)



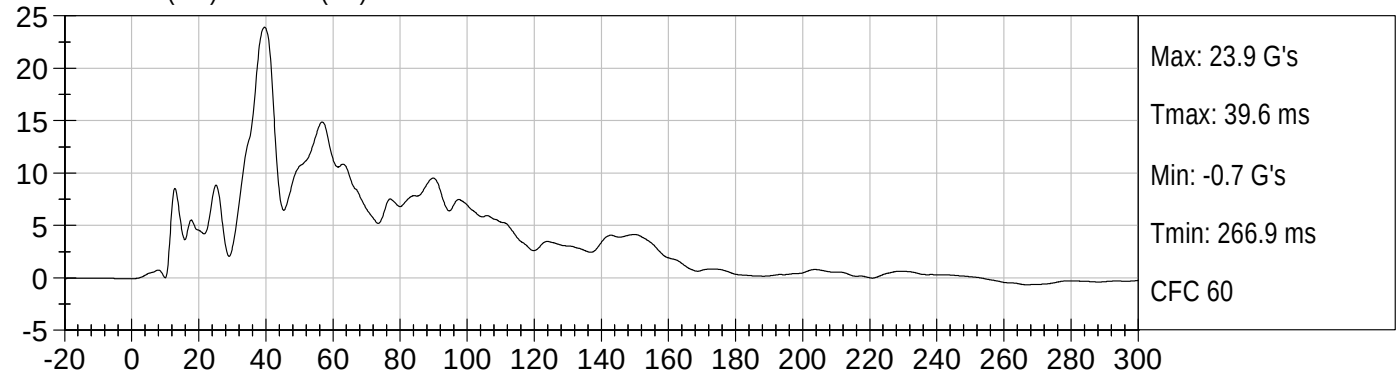

FIREWALL Y (G's) vs TIME (ms)
10
7.5
5
2.5
0
-2.5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 9.3 G's
Tmax: 58.5 ms
Min: -1.7 G's
Tmin: 3.5 ms
CFC 60


FIREWALL Y Velocity (kph) vs TIME (ms)
35
30
25
20
15
10
5
0
-5
-20 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
Max: 30.7 kph
Tmax: 5.9 ms
Min: -1.3 kph
Tmin: 290.7 ms
CFC 180

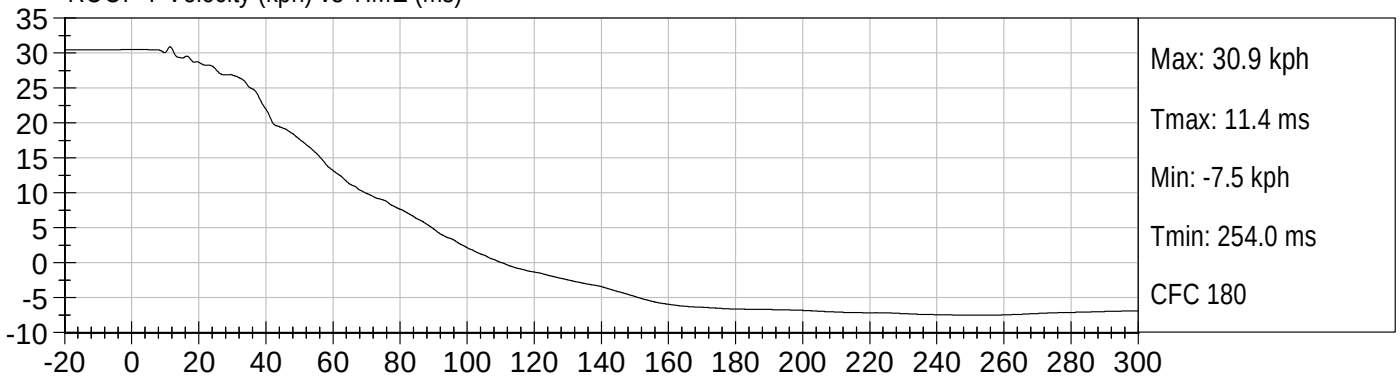
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

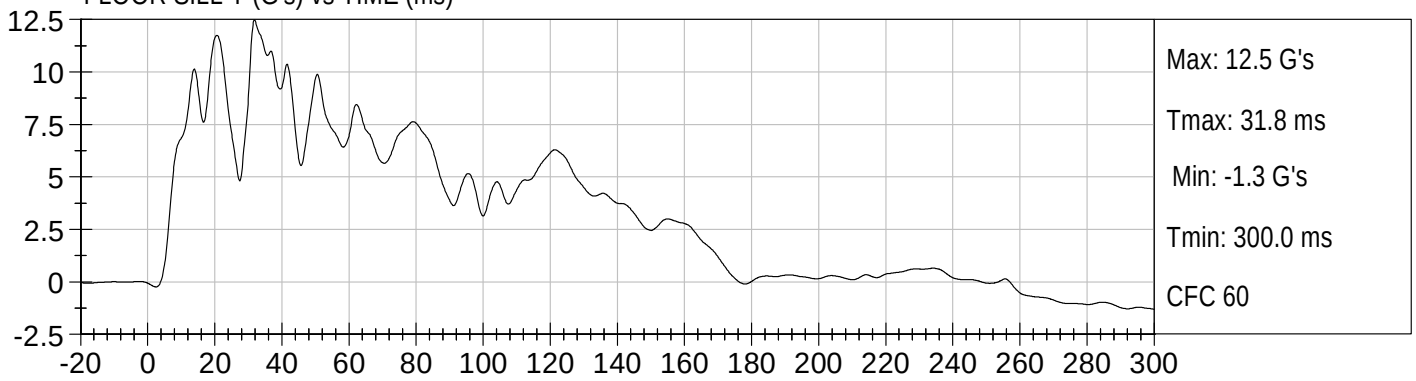
ROOF Y (G's) vs TIME (ms)



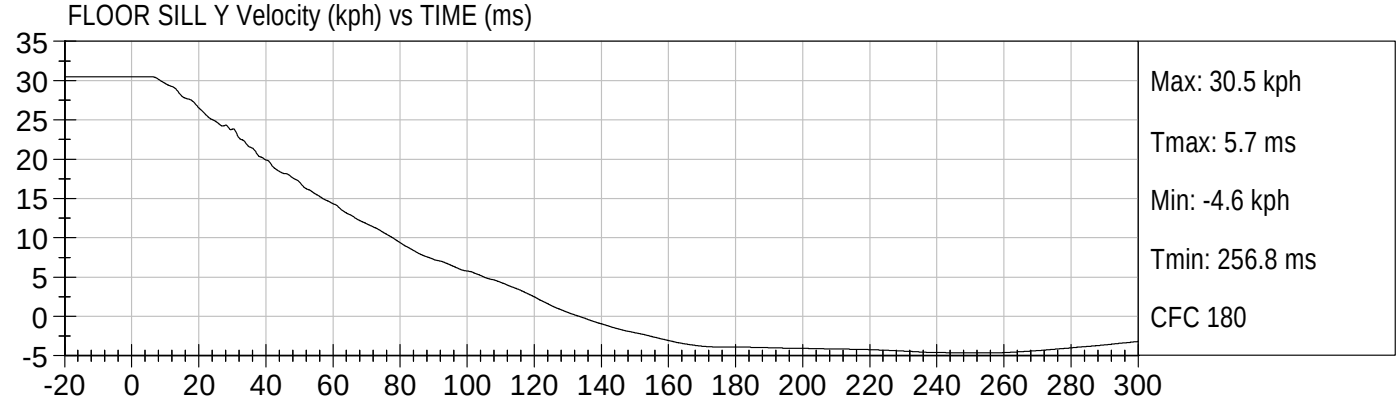
ROOF Y Velocity (kph) vs TIME (ms)



FLOOR SILL Y (G's) vs TIME (ms)



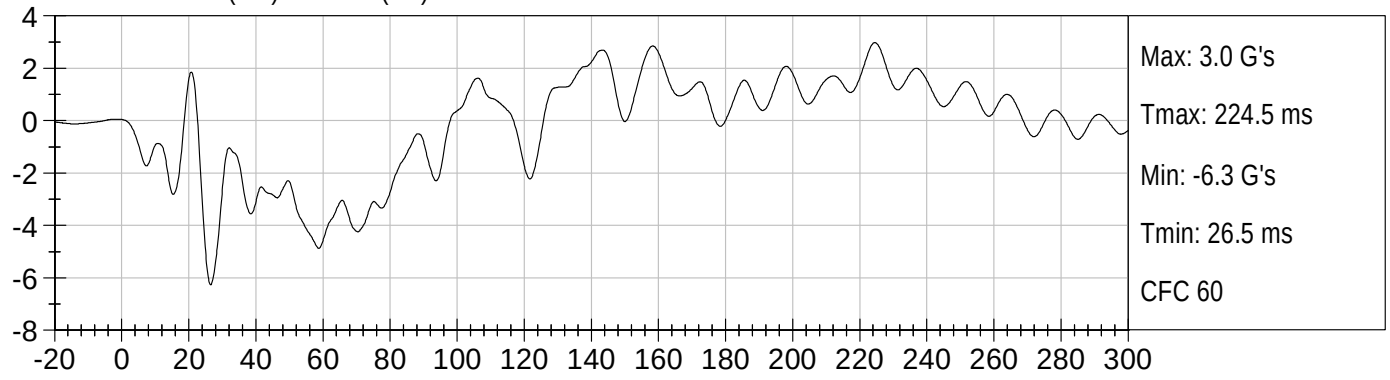
FLOOR SILL Y Velocity (kph) vs TIME (ms)



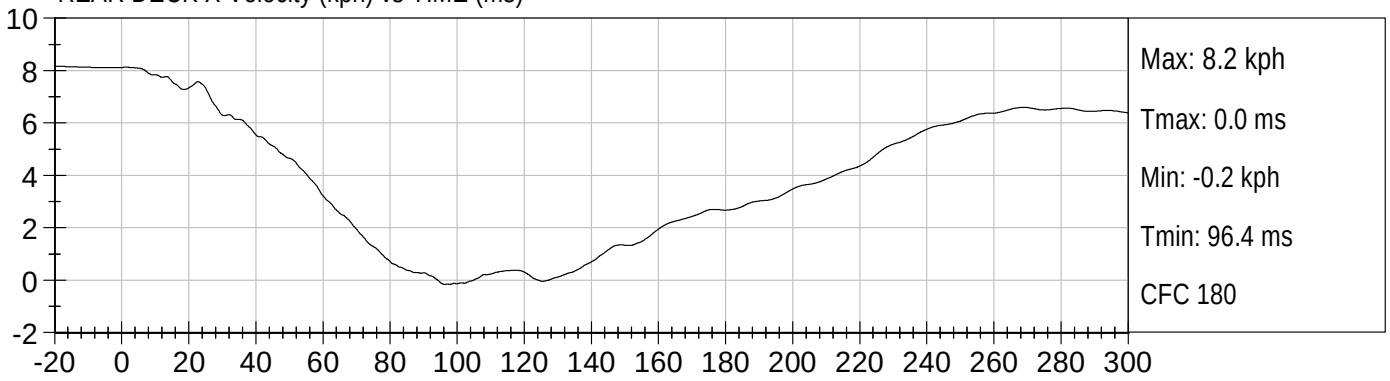
FMVSS 214 Rigid Pole Side Impact
2011 Nissan Altima - CB5204

Test Date: 03/09/2011
Speed: 19.6 mph (31.5 km/h)

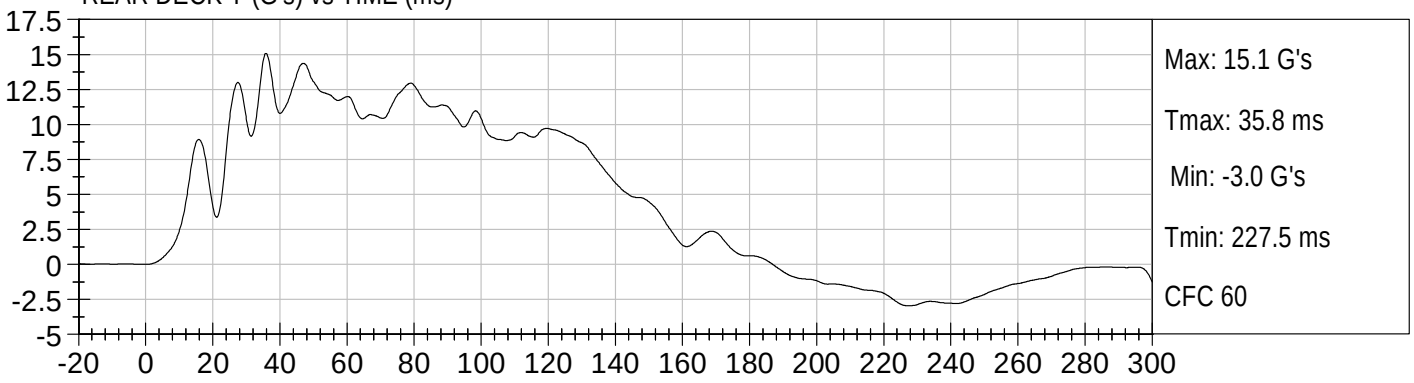
REAR DECK X (G's) vs TIME (ms)



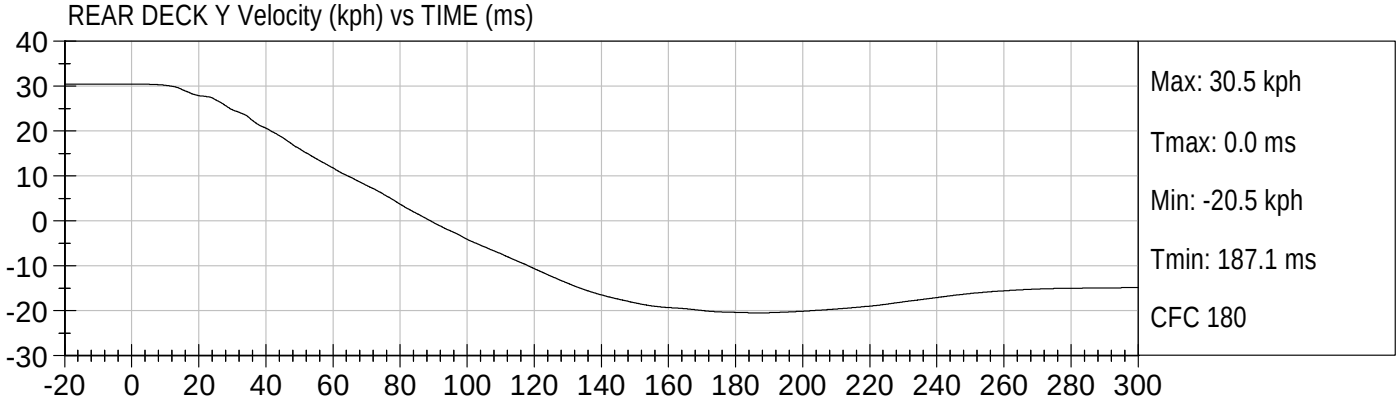
REAR DECK X Velocity (kph) vs TIME (ms)



REAR DECK Y (G's) vs TIME (ms)



REAR DECK Y Velocity (kph) vs TIME (ms)



APPENDIX D

DUMMY PERFORMANCE CALIBRATION TEST DATA

MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D11871

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	125 to 155	148	Pass
Peak Lateral Acceleration	G's	+/- 15	-10.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

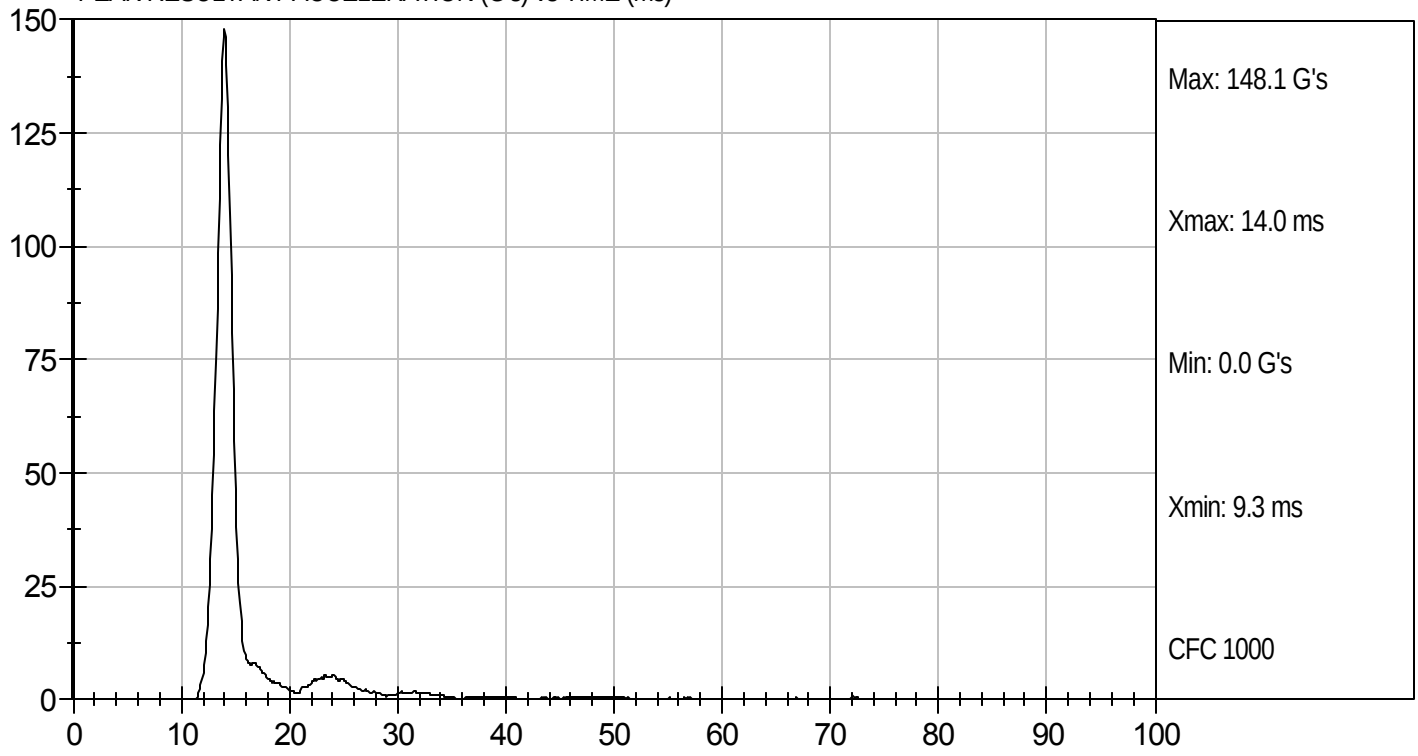
3/7/11
Test Date

David Winkelbauer
Approved By

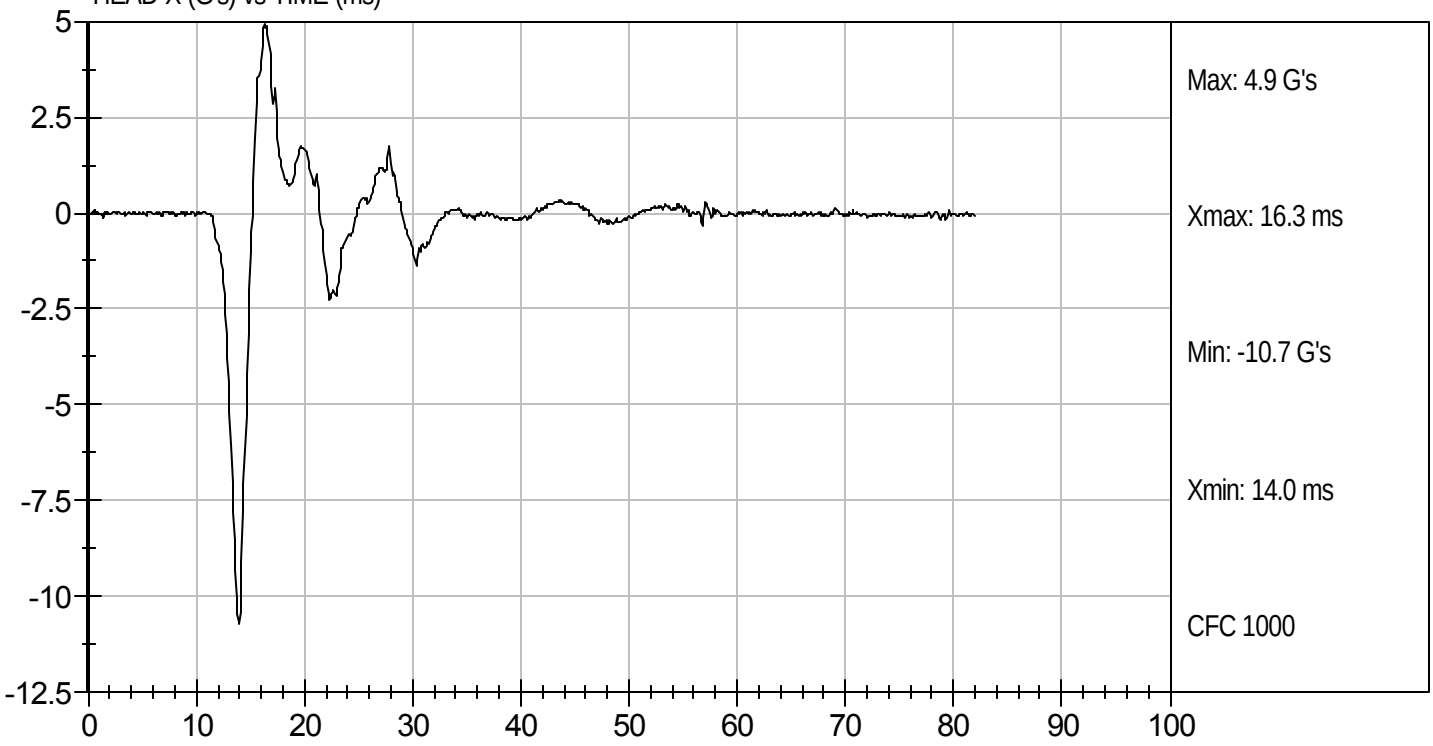
Test Desc: Head Drop
Component ID: D11871

Test Date: 3/7/11
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G's) vs TIME (ms)



HEAD X (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11872

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.5	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.02	Pass
	3 ms	m/s	-0.25 to -0.375	-0.33	Pass
	14 ms	m/s	-3.20 to -3.70	-3.35	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	51.1	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	62.3	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	56.1	Pass
			Overall Test Results		Pass

Jessica Gall
Laboratory Technician

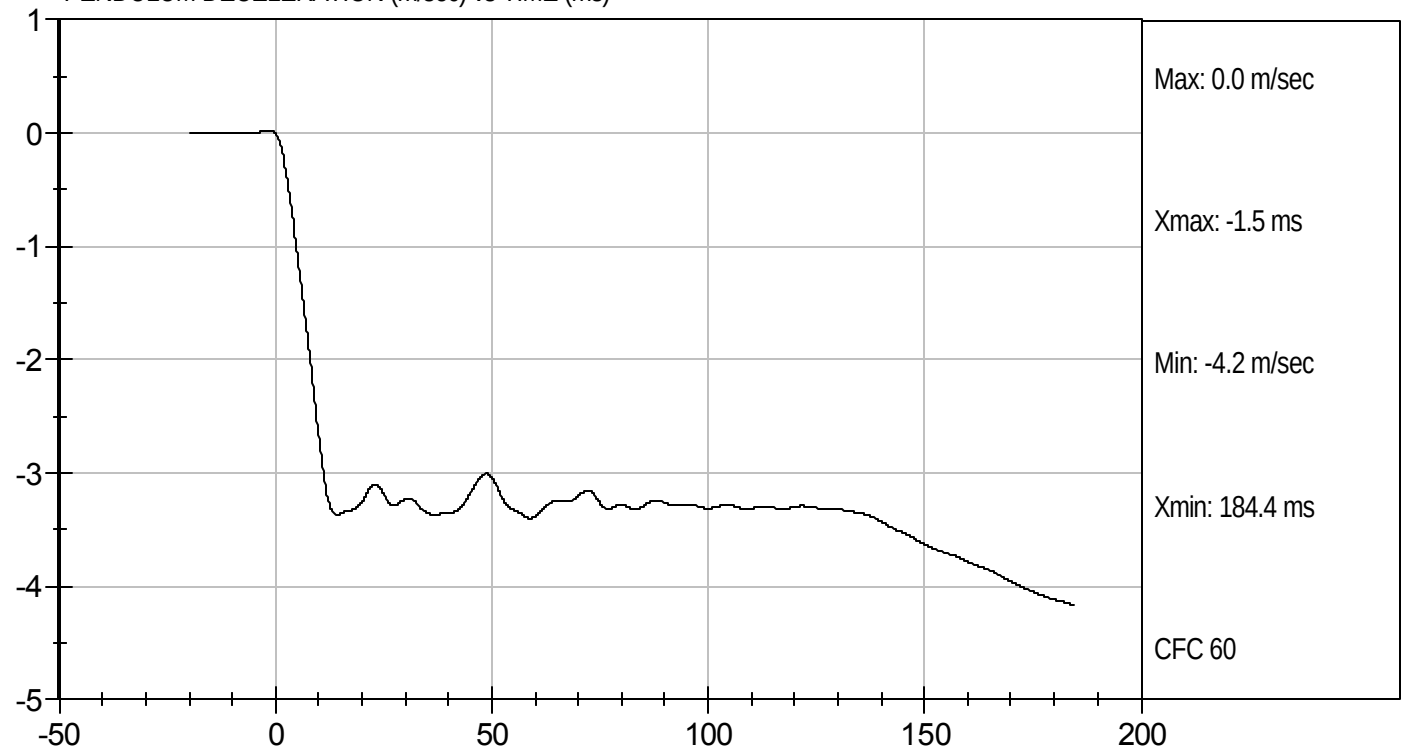
3/7/11
Test Date

David Winkelbauer
Approved By

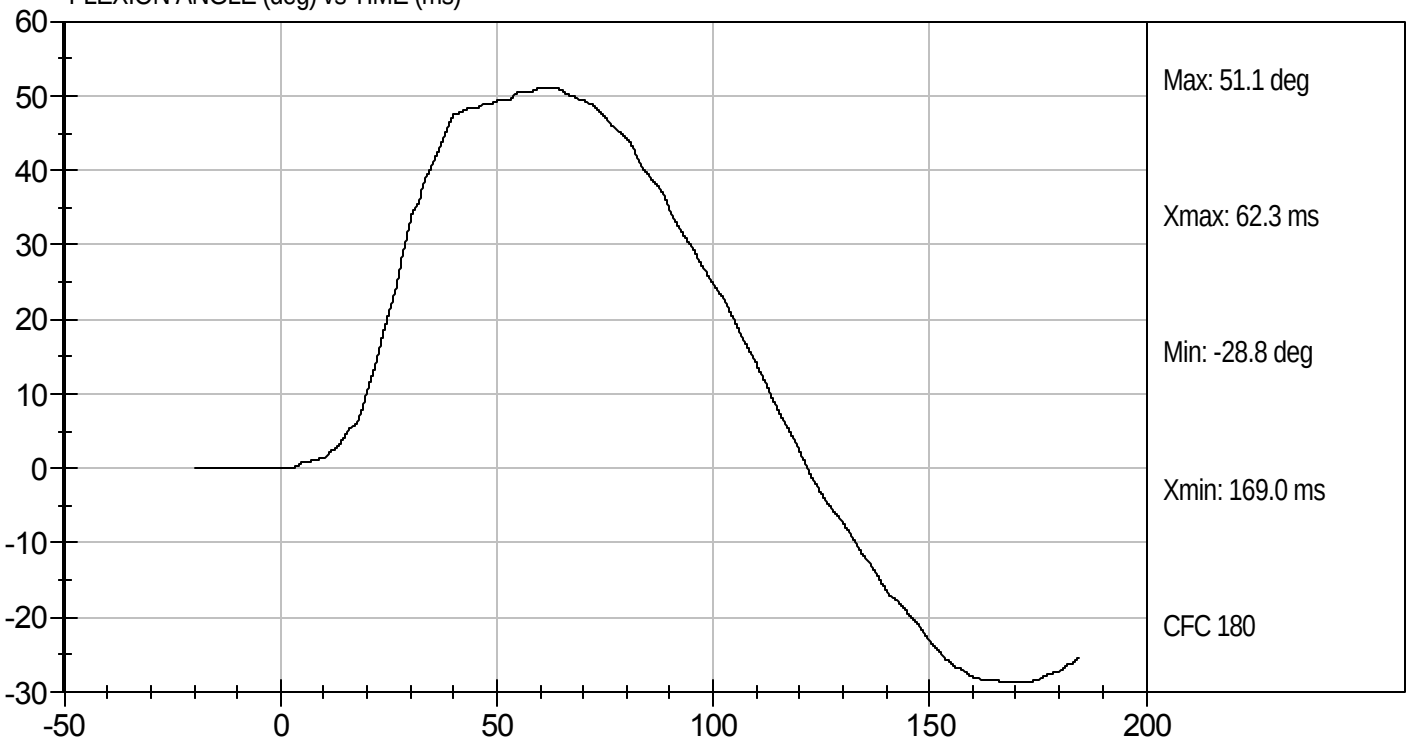
Test Desc: Neck Bending
Component ID: D11872

Test Date: 3/7/11
Velocity: 11.34 ft/s, 3.46 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

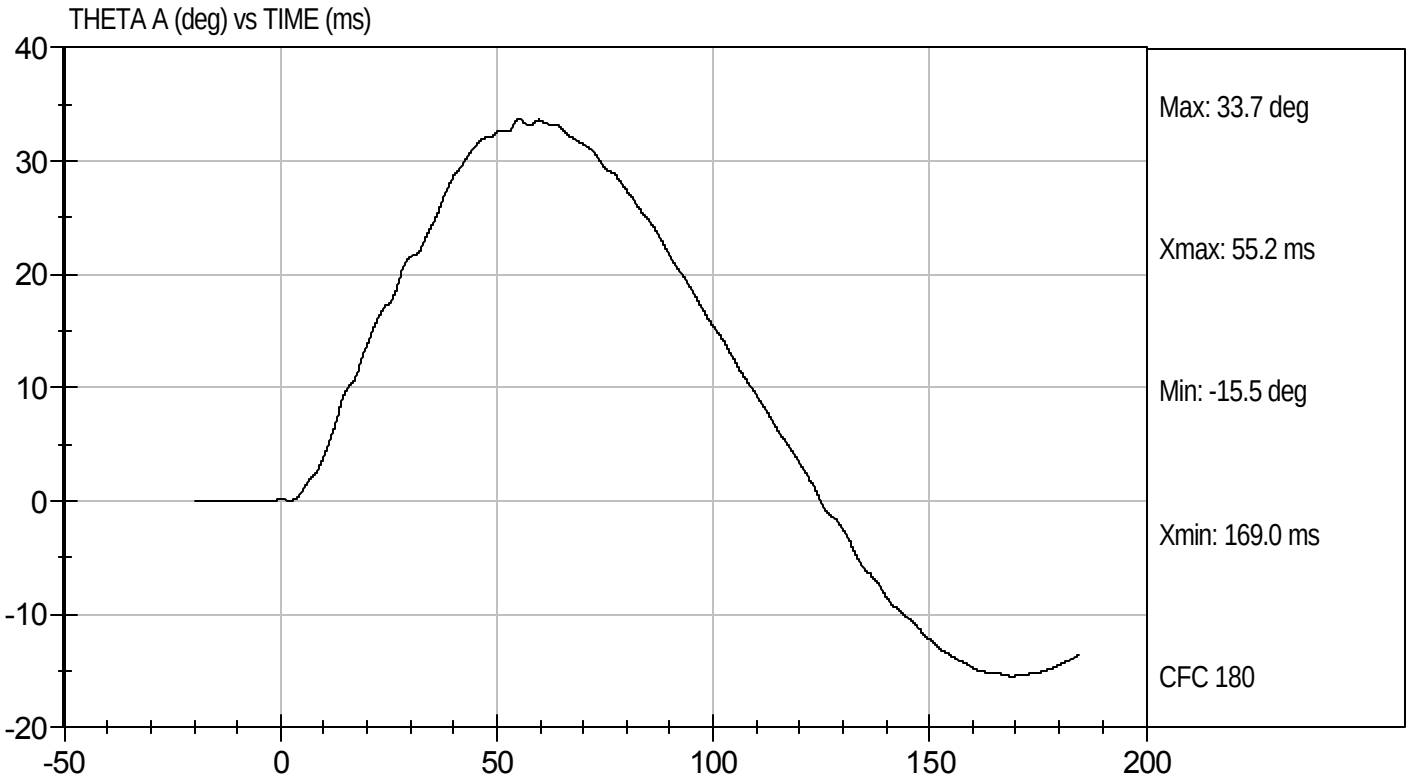


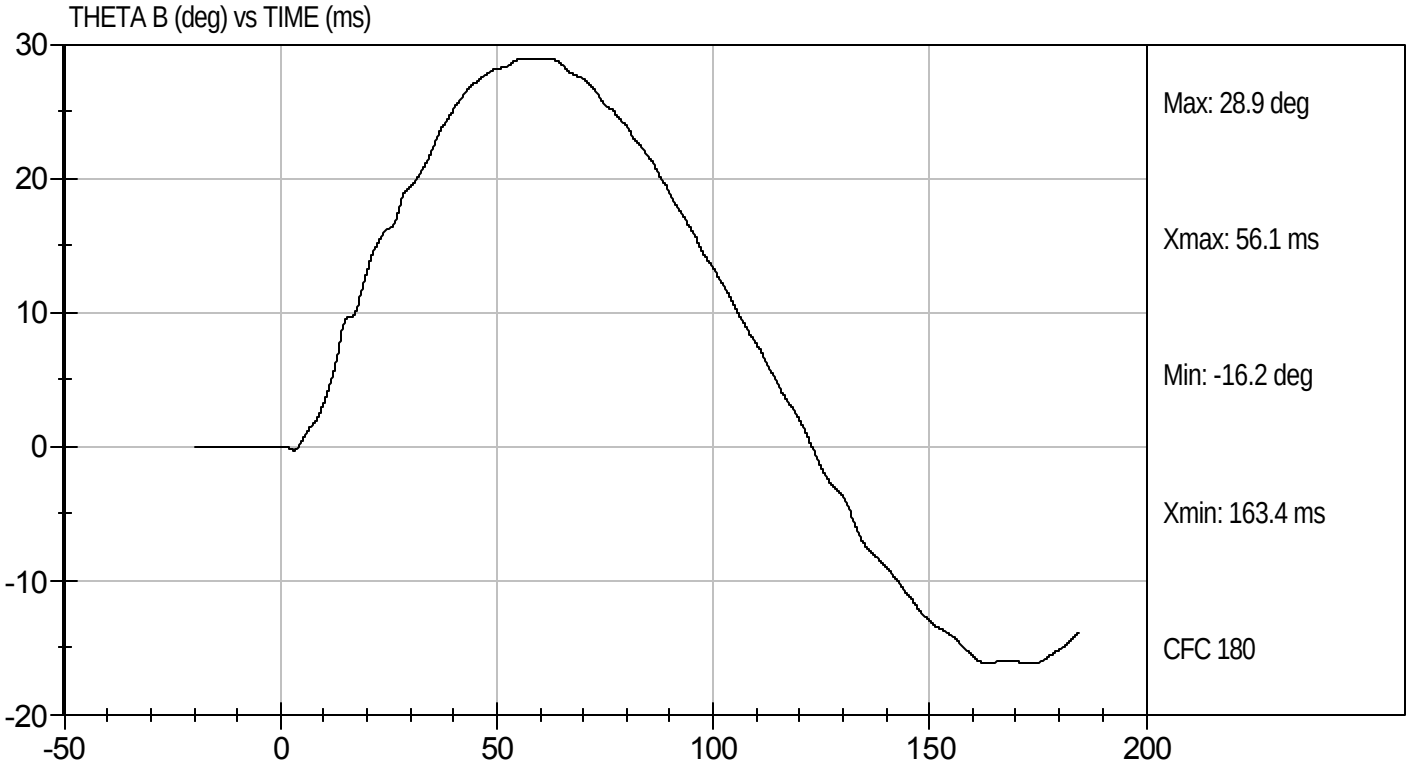
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D11872

Test Date: 3/7/11
Velocity: 11.34 ft/s, 3.46 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11873

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	8.4	Pass
Time of Peak Shoulder Acceleration	ms	NA	13.1	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

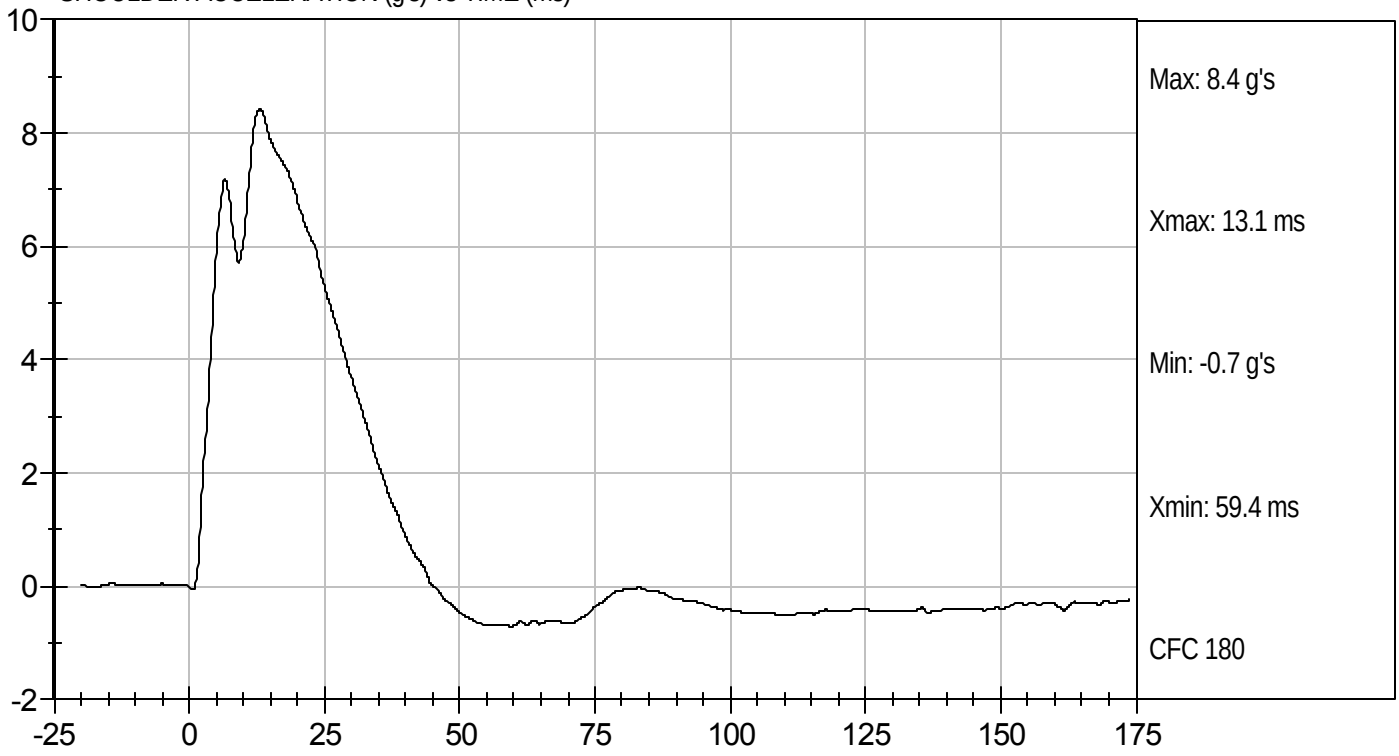
3/7/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11873

Test Date: 3/7/11
Velocity: 14.36 ft/s, 4.4 m/s

SHOULDER ACCELERATION (g's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11874

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.4	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.3	Pass
		Overall Test Results		Pass

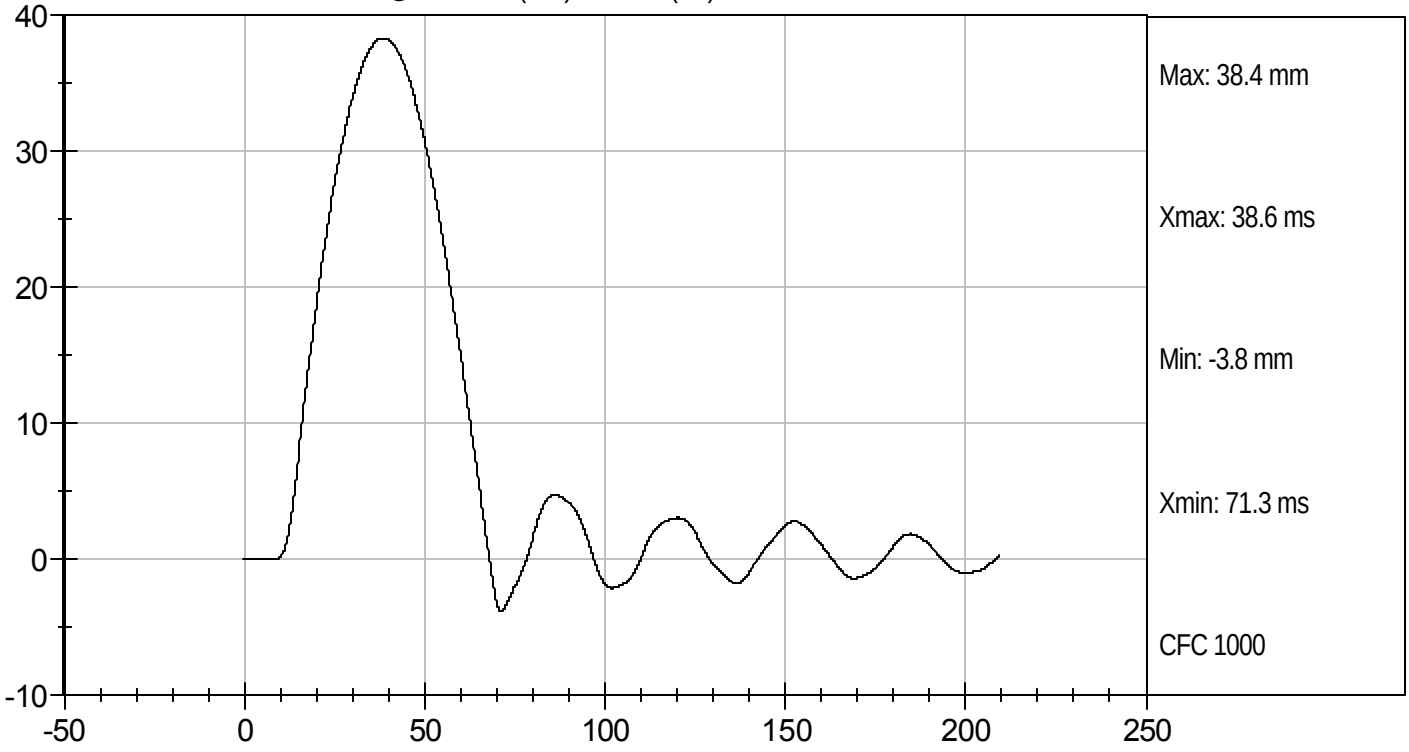
Jessica Gall
Laboratory Technician

3/7/11
Test Date

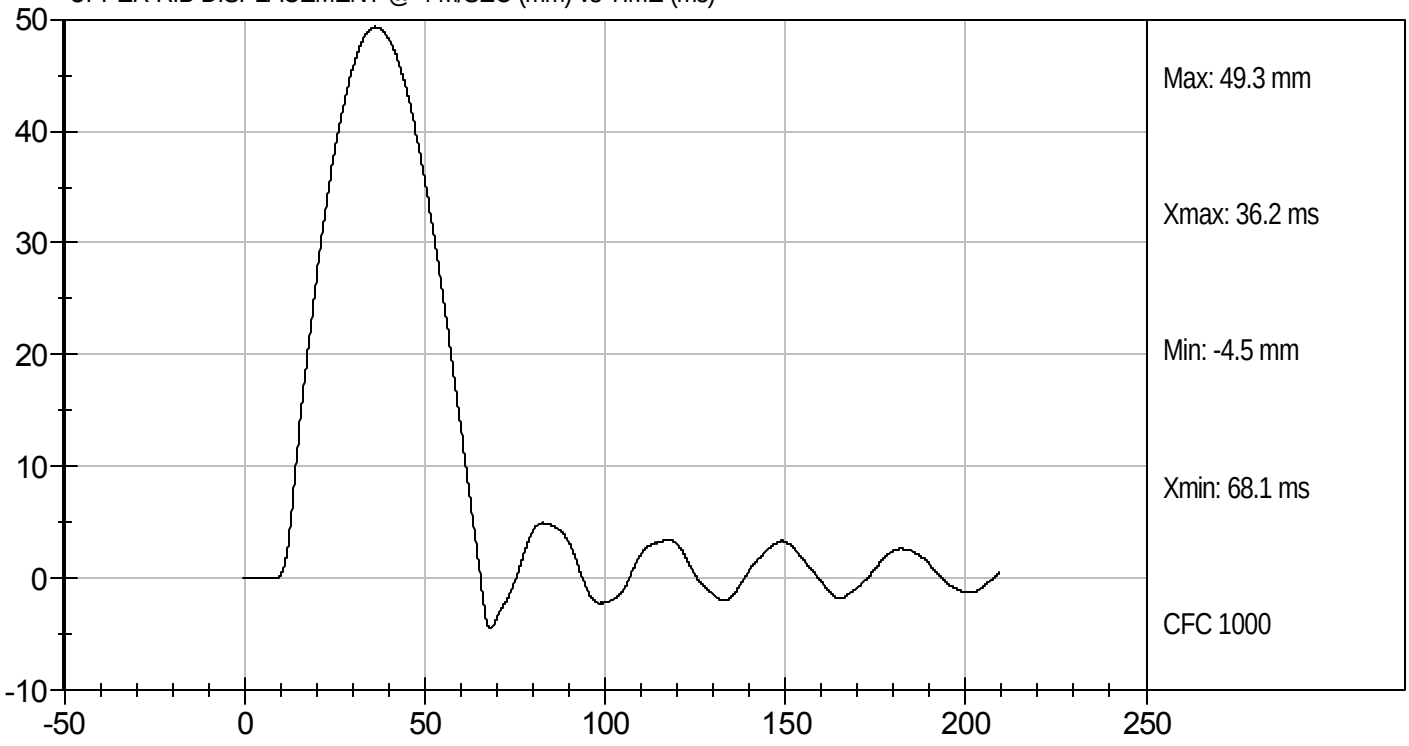
David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D11874
Test Date: 3/7/11

UPPER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11875

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.2	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	50.3	Pass
		Overall Test Results		Pass

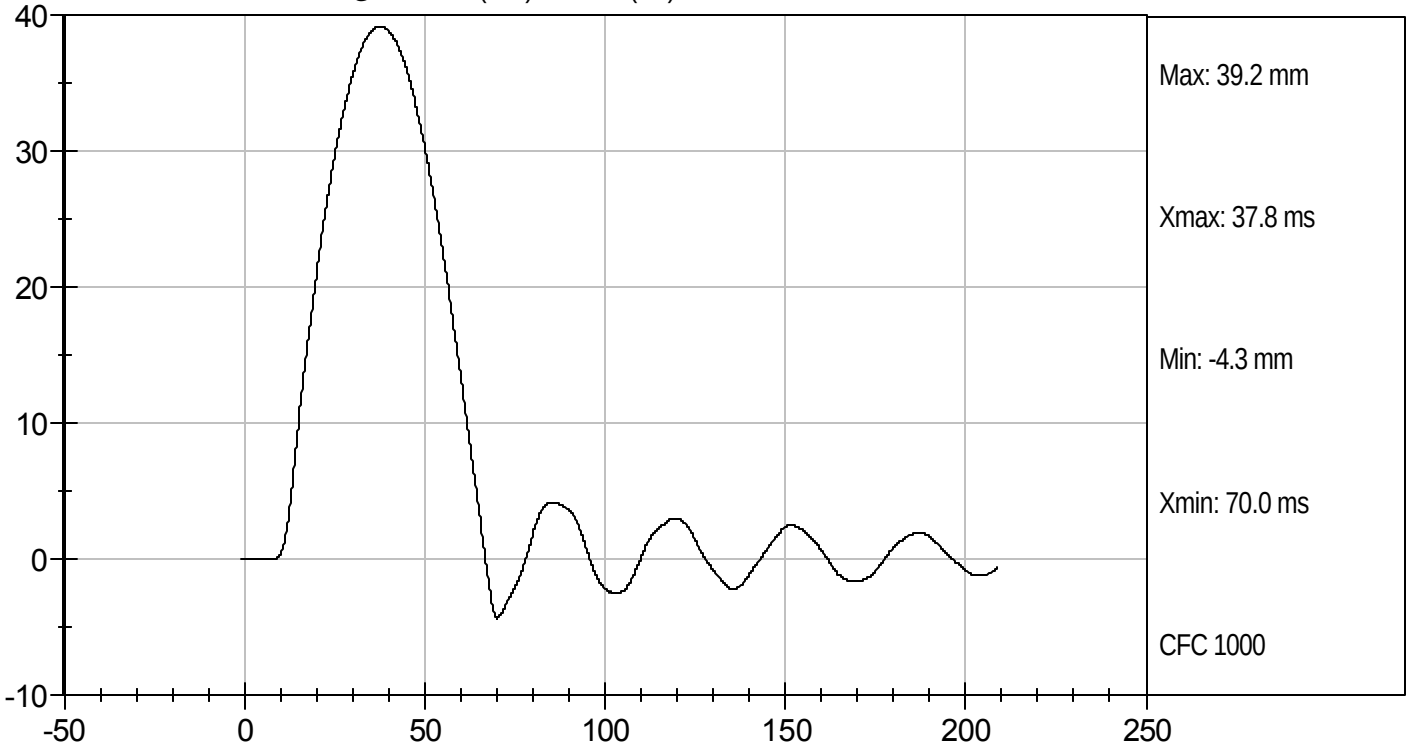
Jessica Hall
Laboratory Technician

3/7/11
Test Date

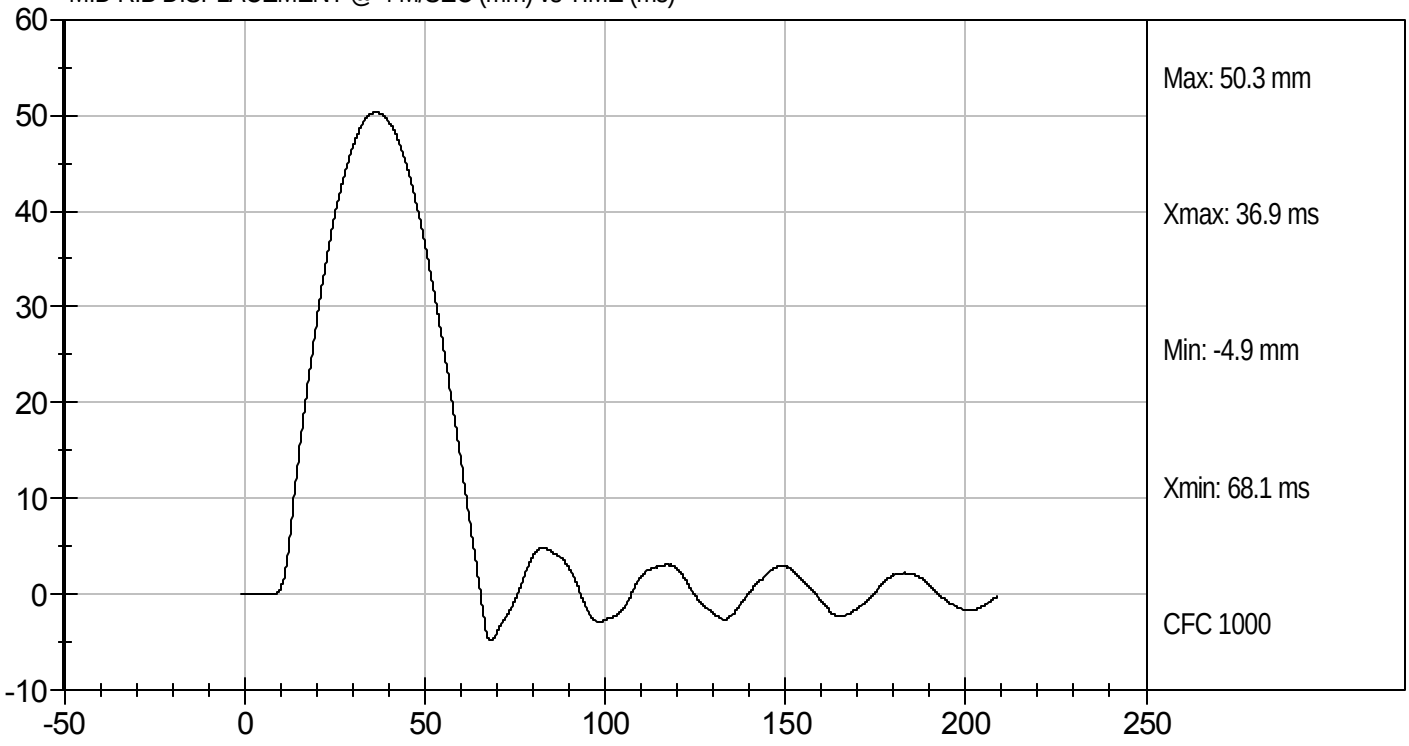
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D11875
Test Date: 3/7/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11876

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	37.5	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	48.7	Pass
		Overall Test Results		Pass

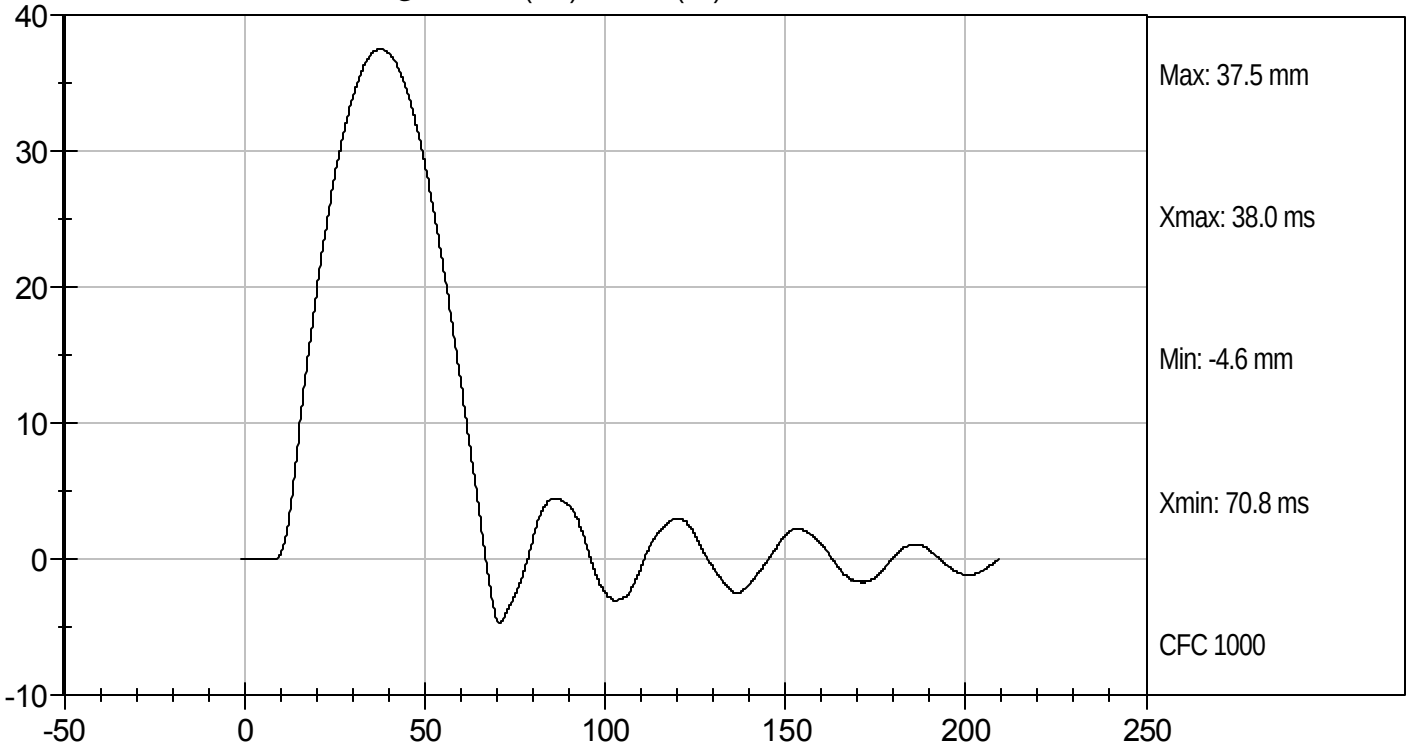
Jessica Hall
Laboratory Technician

3/7/11
Test Date

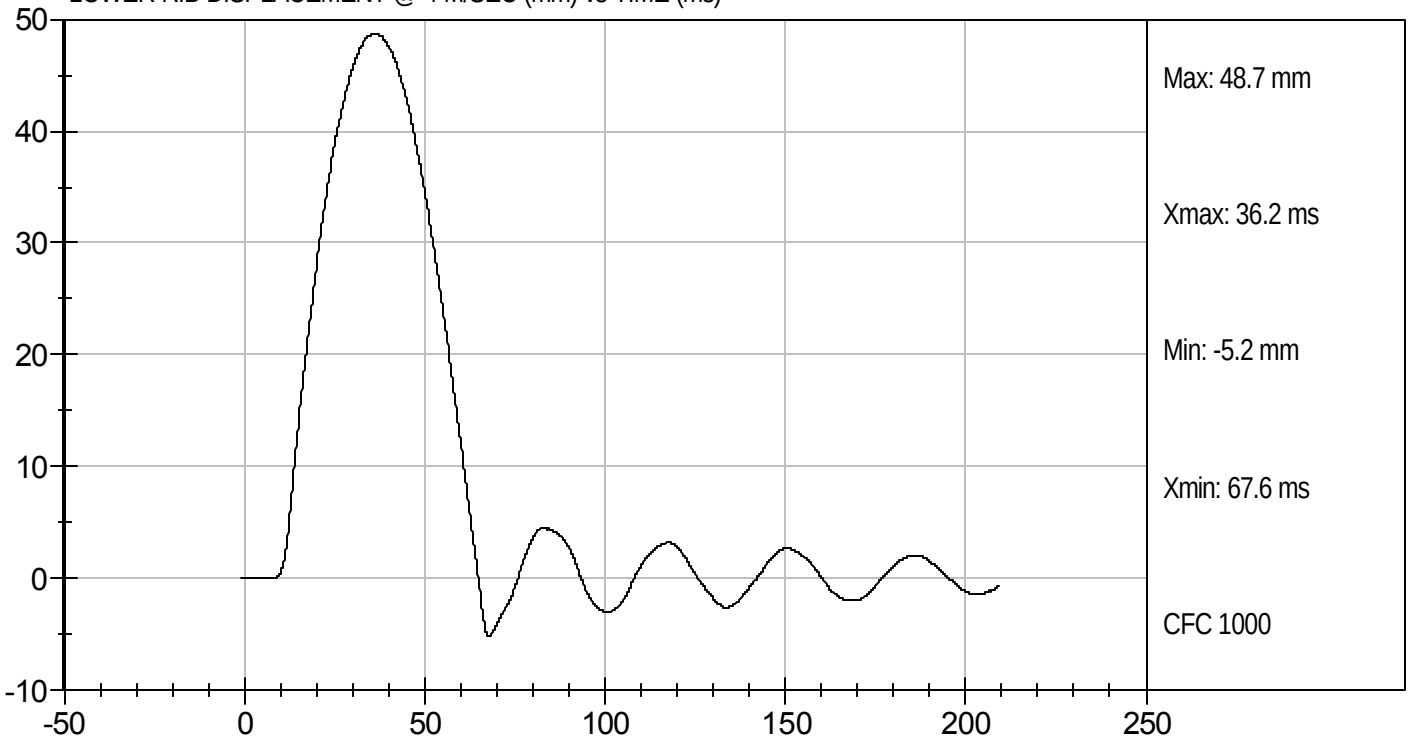
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D11876
Test Date: 3/7/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11877

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.7	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Speed	m/s	3.90 to 4.10	4.03	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.09	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	10.70	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.51	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	10.10	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

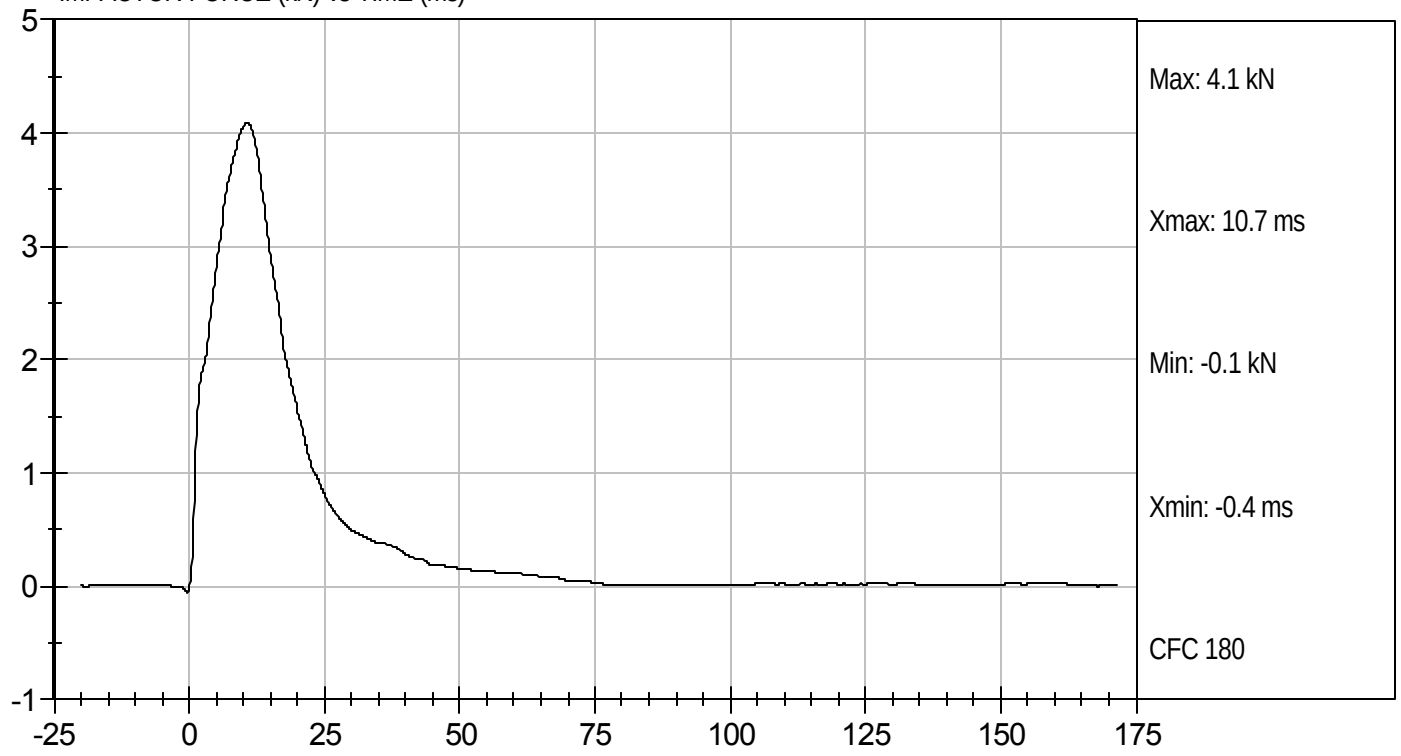
3/8/11
Test Date

David Winkelbauer
Approved By

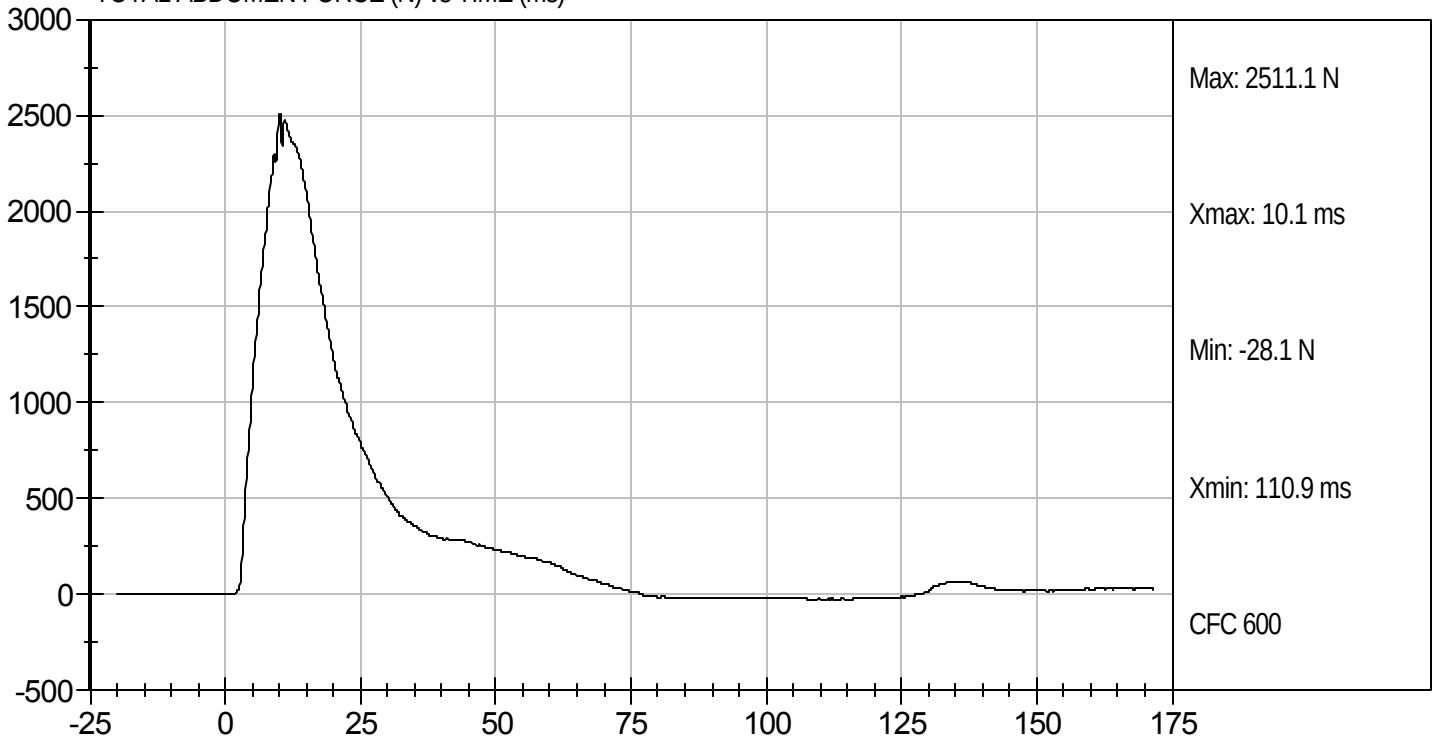
Test Desc: Abdomen Impact
Component ID: D11877

Test Date: 3/8/11
Velocity: 13.23 ft/s, 4.03 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11878

Tested Parameter		Units	Specification		
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	21	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.01	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.28	Pass
	27 ms	m/s	-6.50 to -5.80	-5.84	Pass
	30 ms	m/s	>= -6.5	-5.97	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	49.6	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	45.8	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	45	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

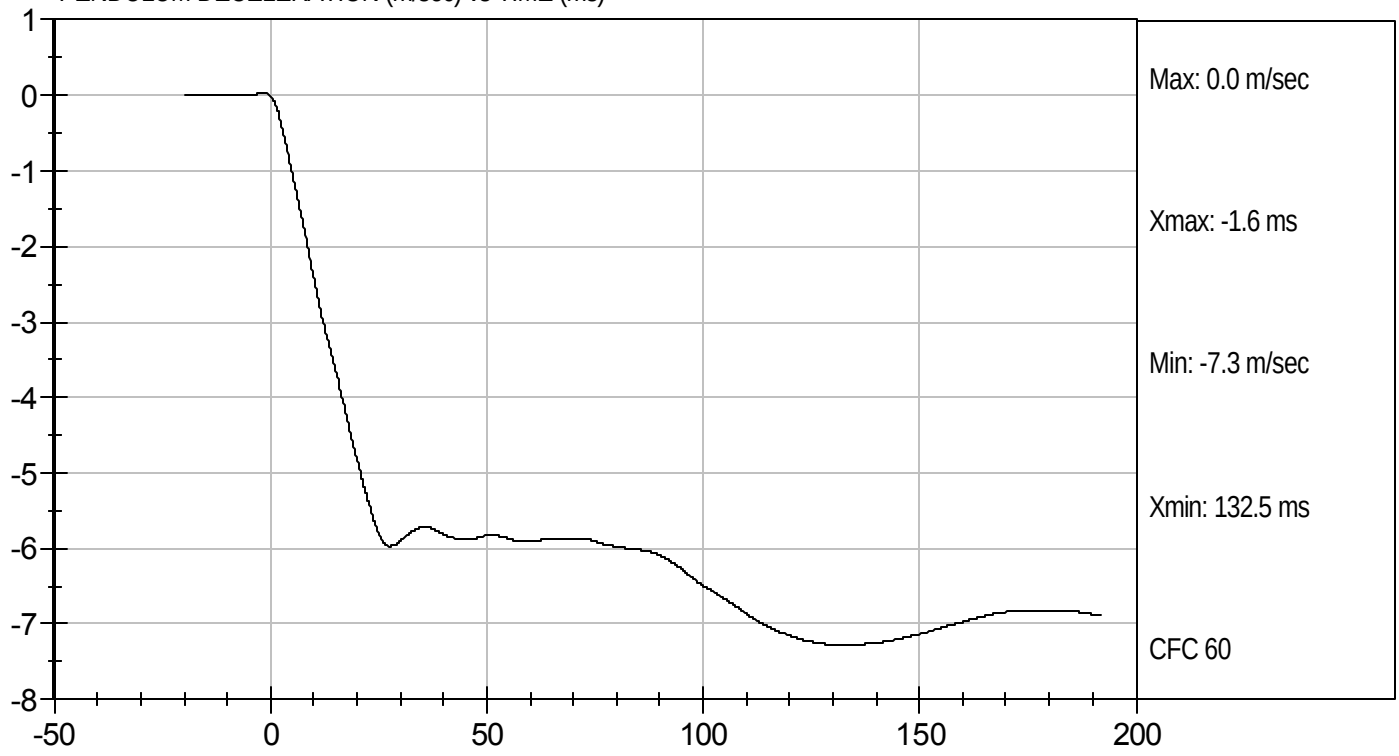
3/7/11
Test Date

David Winkelbauer
Approved By

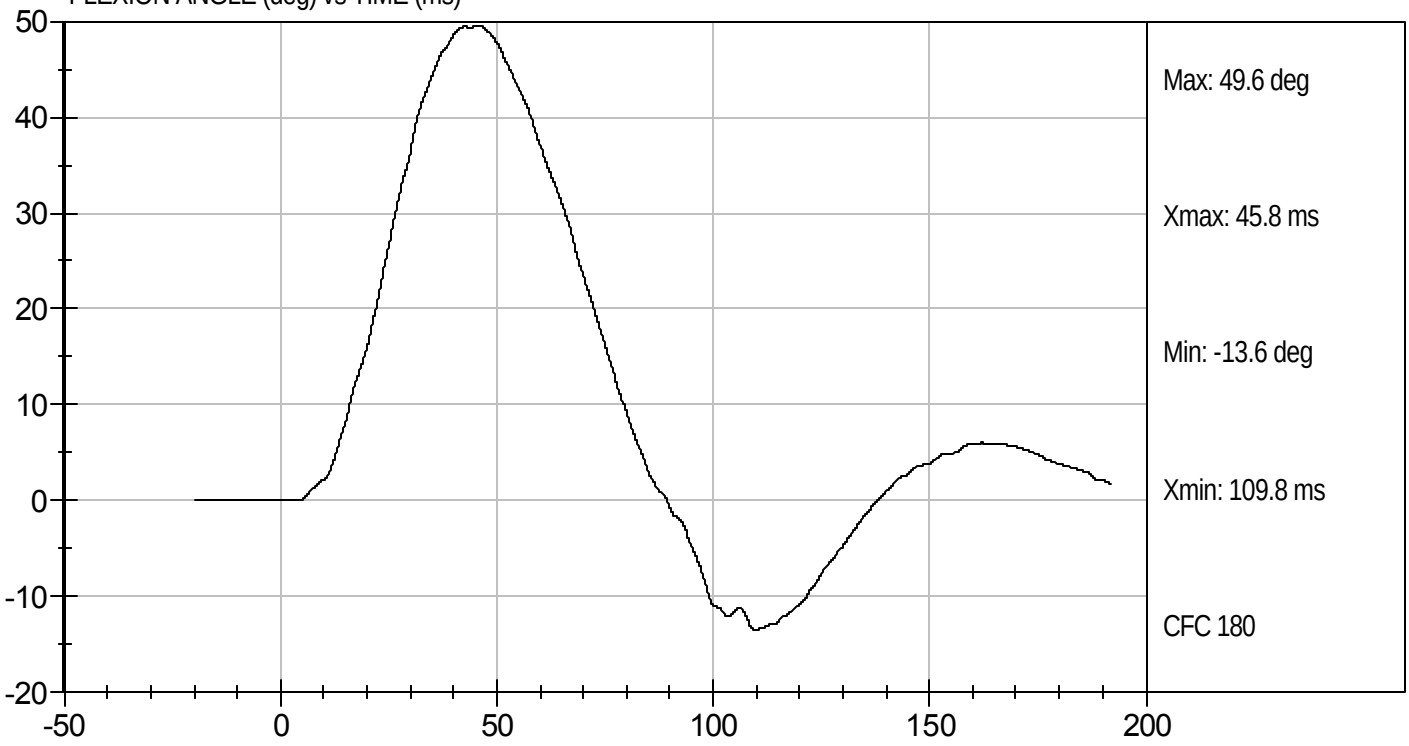
Test Desc: Lumbar Bending
Component ID: D11878

Test Date: 3/7/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

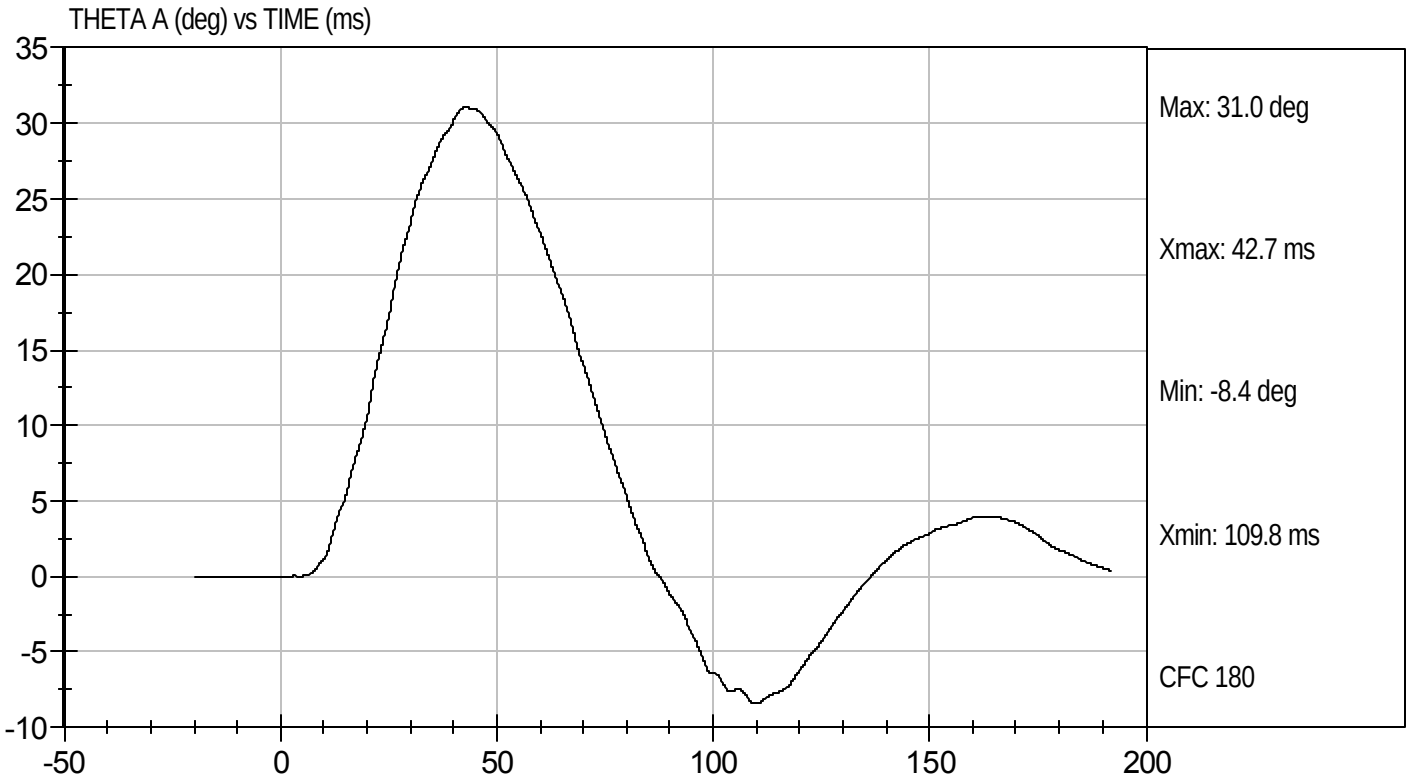


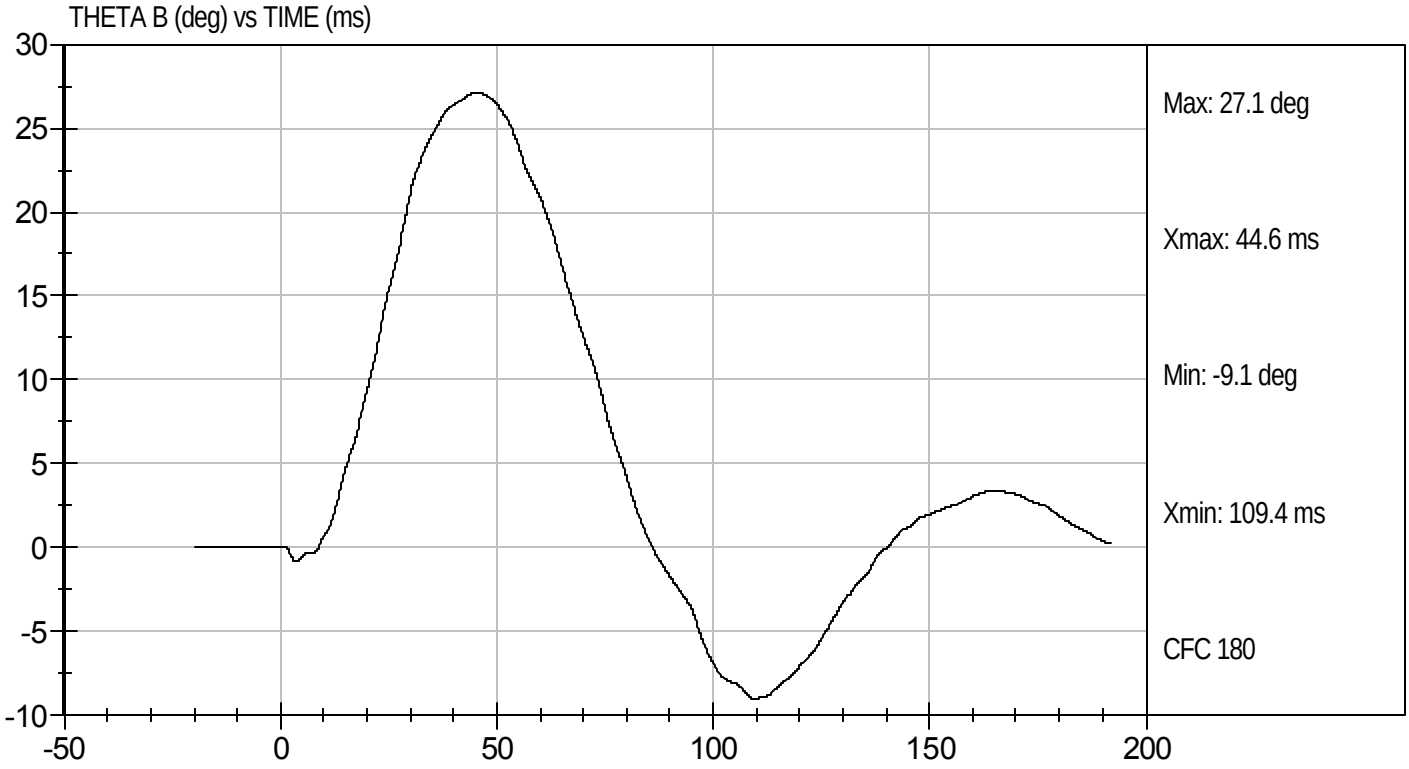
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D11878

Test Date: 3/7/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11879

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	24	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.86	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.70	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.49	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.10	Pass
		Overall Test Results		Pass

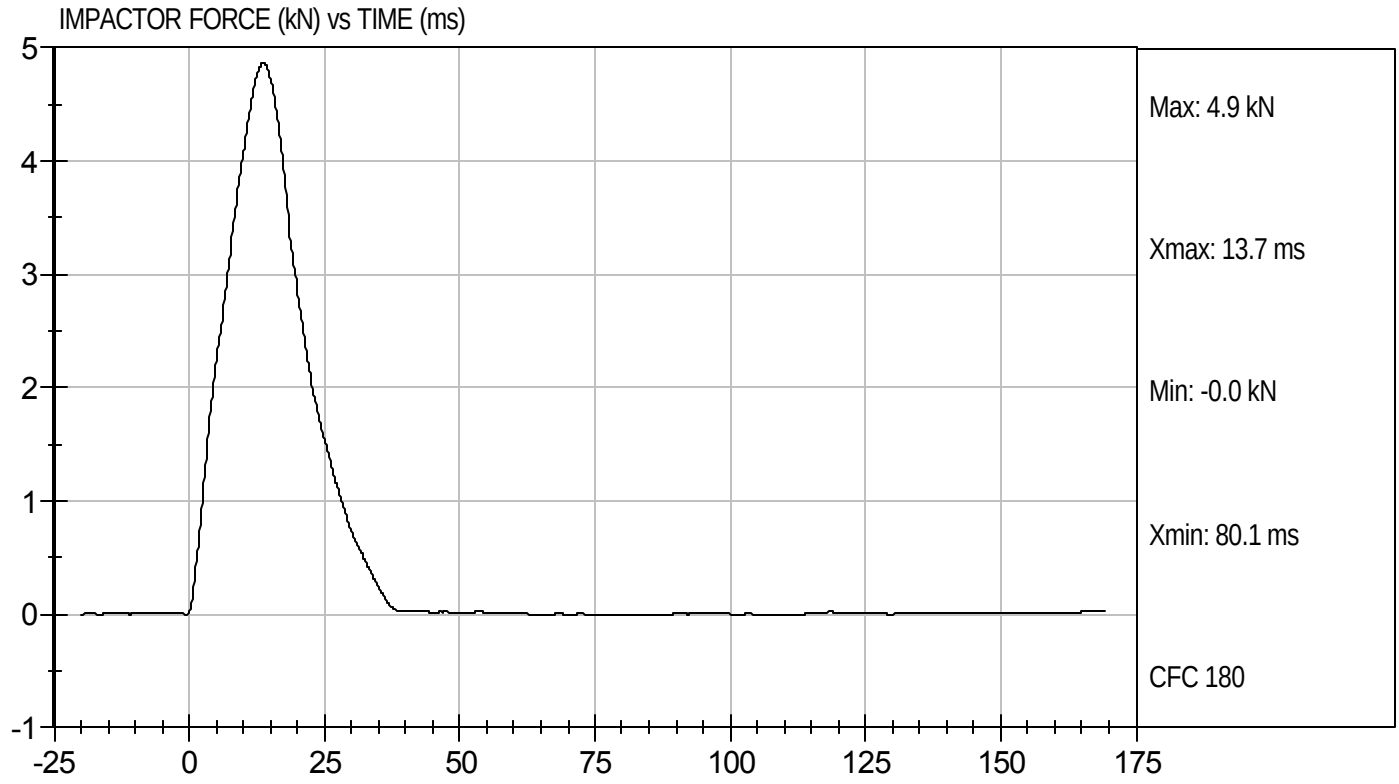
Jessica Gall
Laboratory Technician

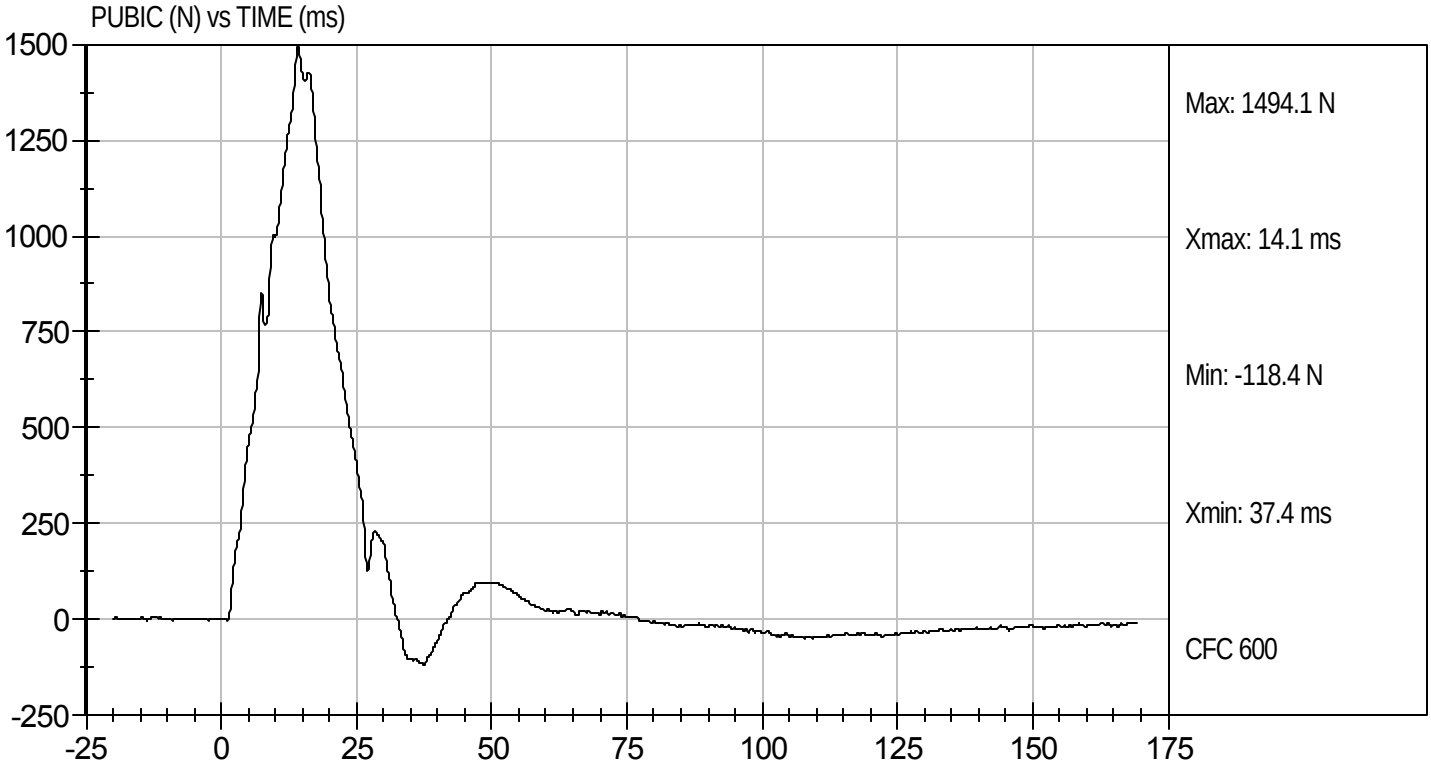
3/8/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D11879

Test Date: 3/8/11
Velocity: 14.25 ft/s, 4.34 m/s





MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11870

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Humidity	%	10 to 70	24	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.12	Pass
Upper Rib Displacement	mm	34.0 to 41.0	40.1	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.8	Pass
Lower Rib Displacement	mm	37.0 to 44.0	39.9	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

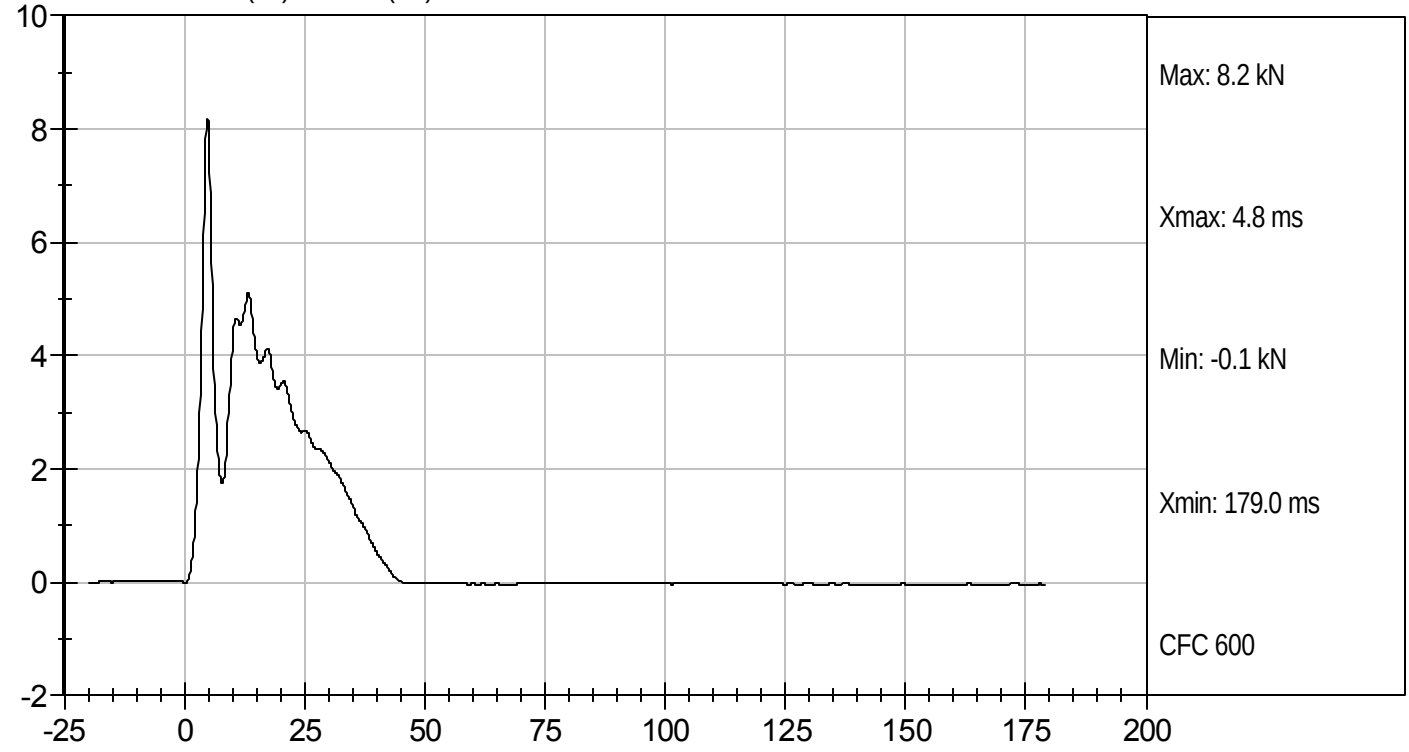
3/8/11
Test Date

David Winkelbauer
Approved By

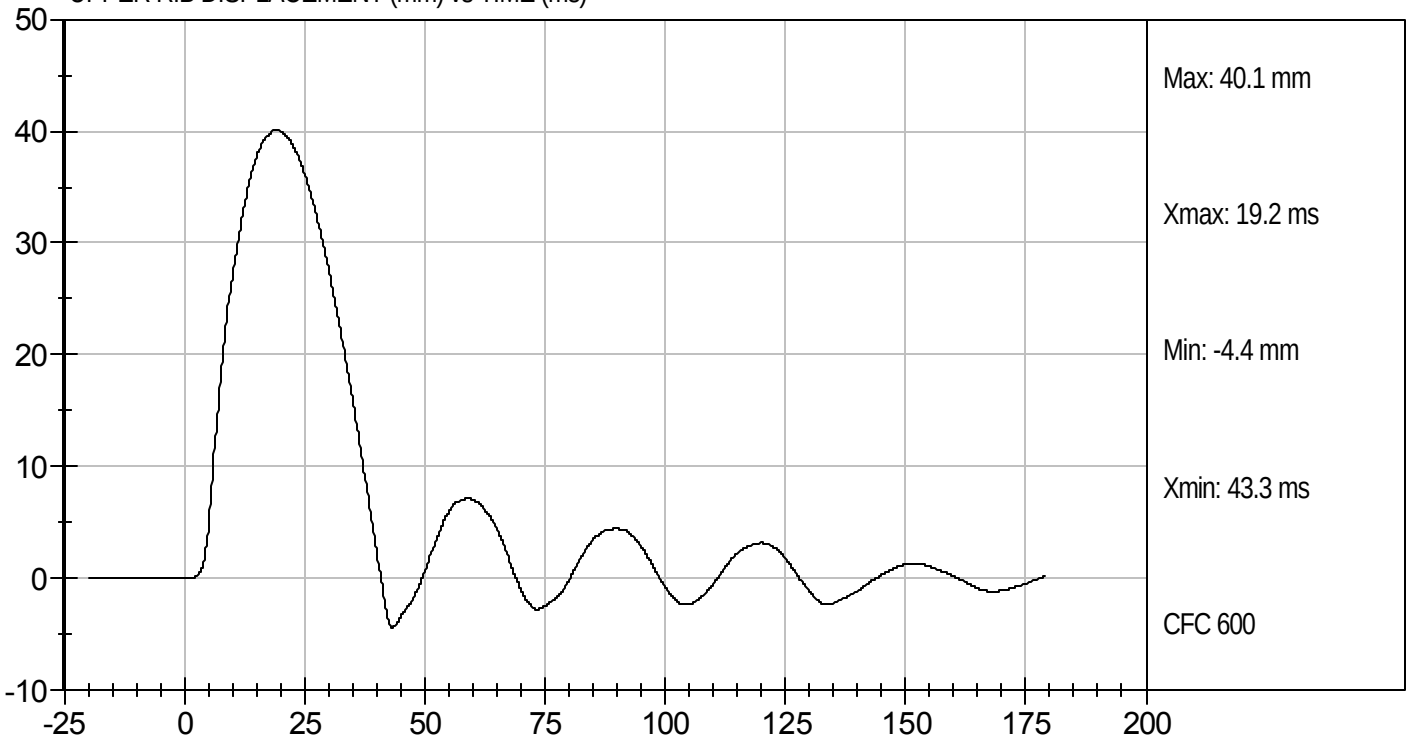
Test Desc: Thorax Impact
Component ID: D11870

Test Date: 3/8/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



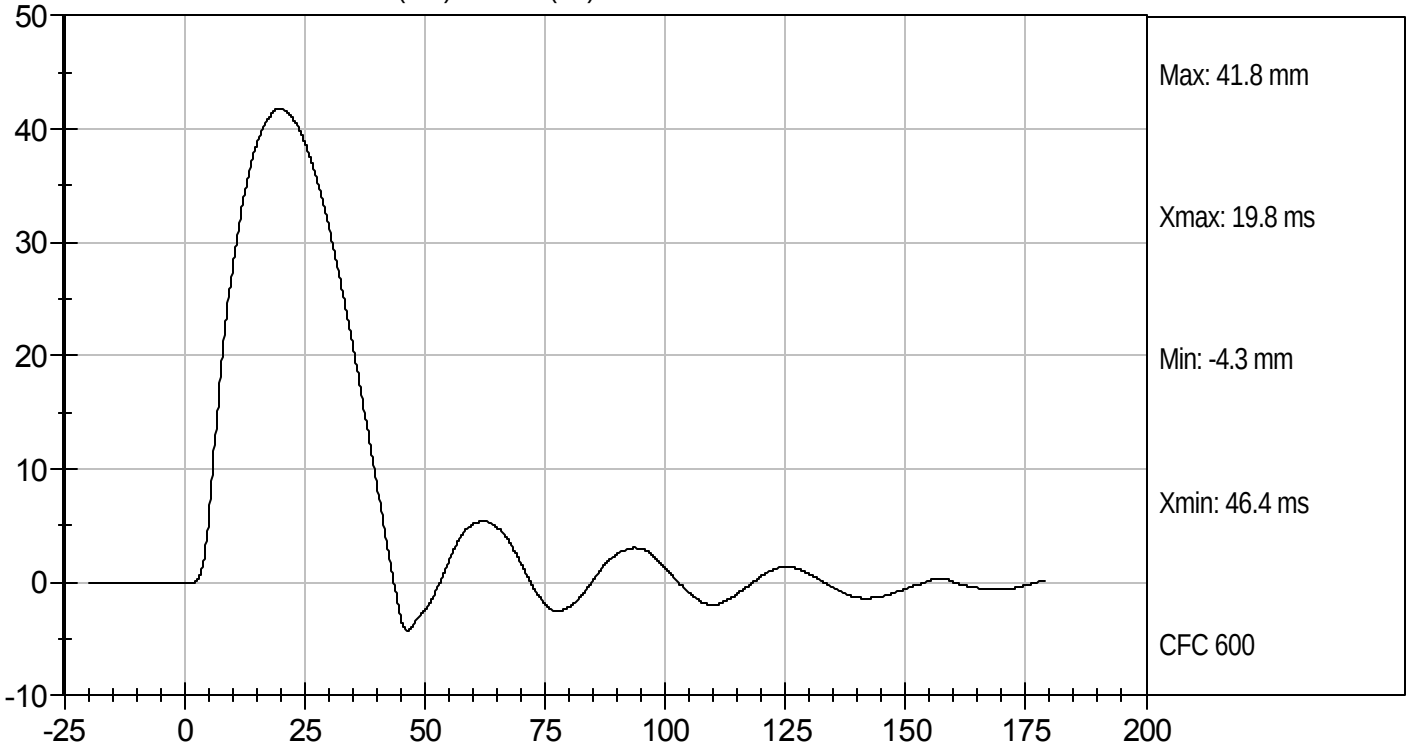
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



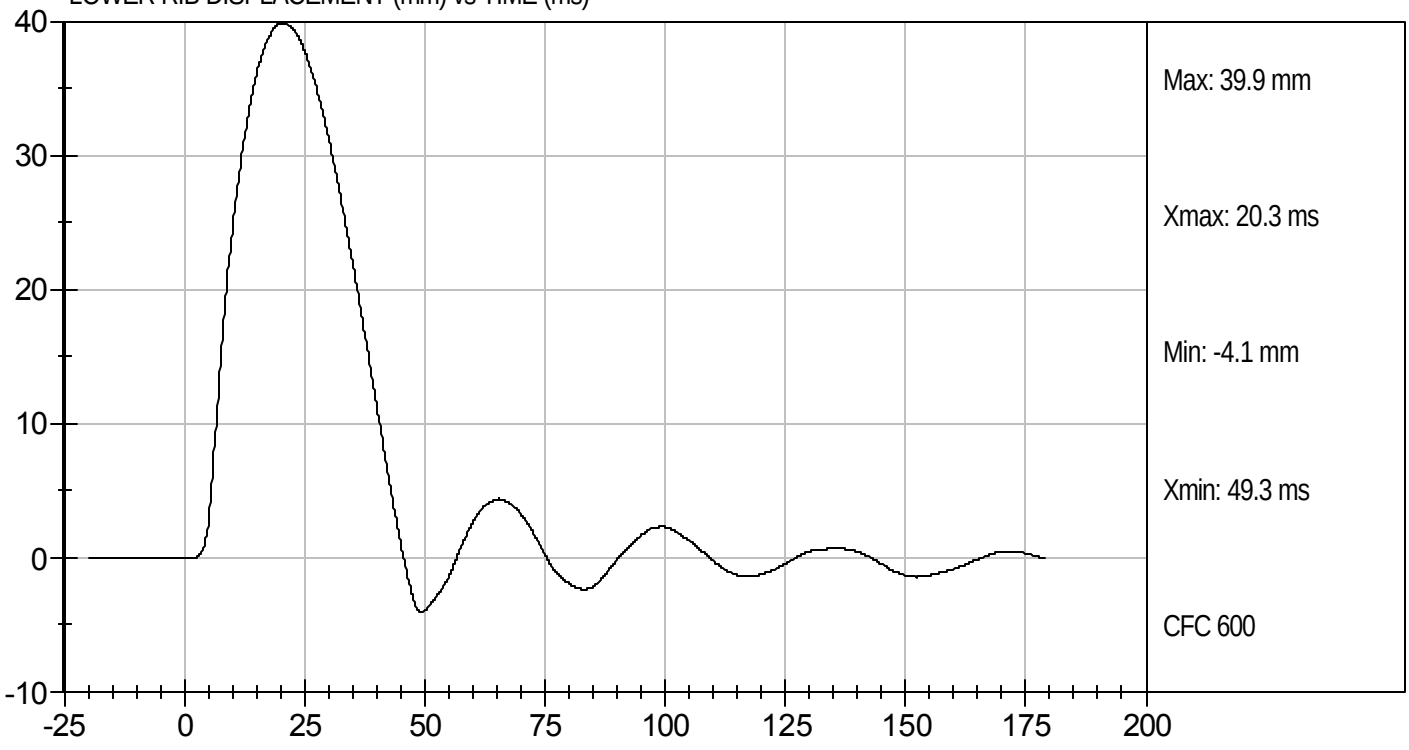
Test Desc: Thorax Impact
Component ID: D11870

Test Date: 3/8/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

HEAD DROP TEST

ES-2re DUMMY

ATD Serial No: 016 **Test ID:** D11891

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Peak Resultant Acceleration	G's	125 to 155	149	Pass
Peak Lateral Acceleration	G's	+/- 15	-8.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 15% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

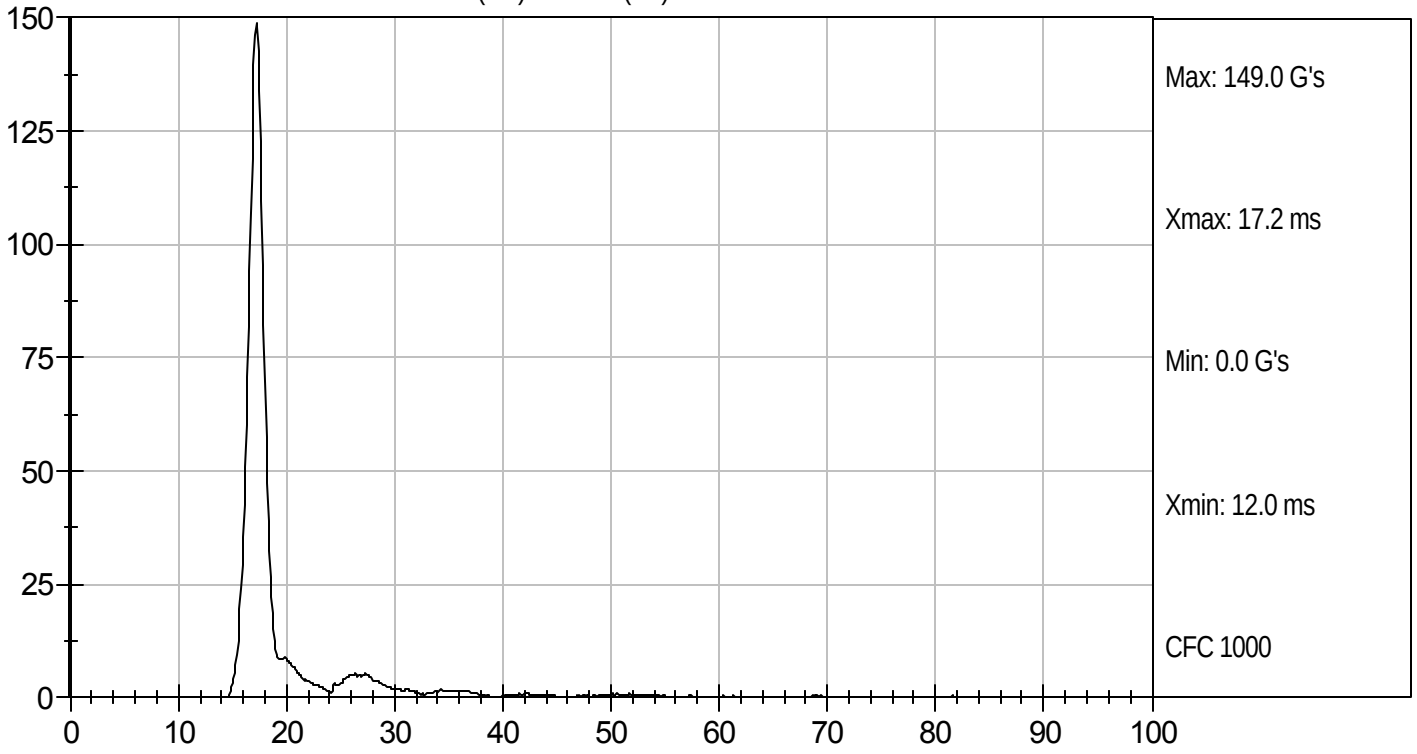
3/9/11
Test Date

David Winkelbauer
Approved By

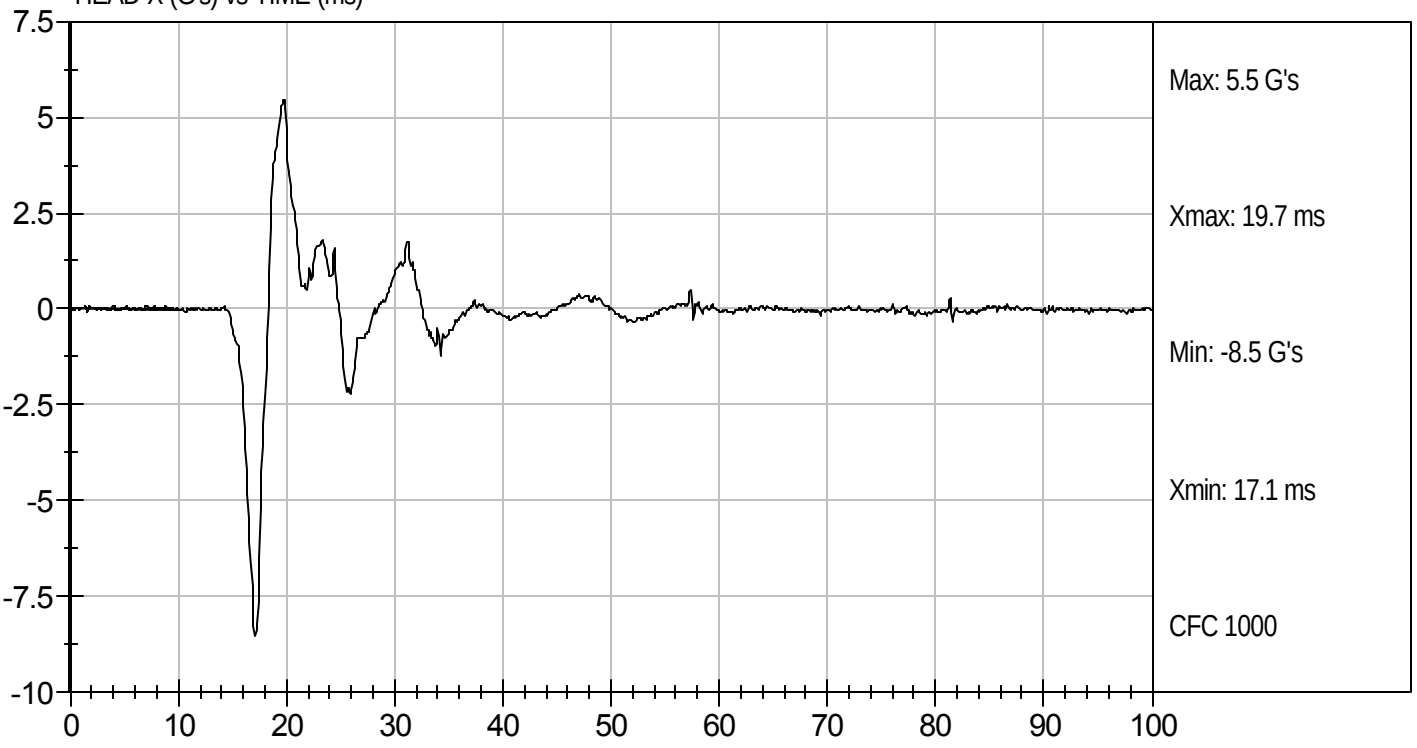
Test Desc: Head Drop
Component ID: D11891

Test Date: 3/9/11
Velocity: 0 ft/s, 0 m/s

PEAK RESULTANT ACCELERATION (G's) vs TIME (ms)



HEAD X (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

NECK PENDULUM TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11892

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	18.0 to 22.0	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	3.3 to 3.5	3.4	Pass
Pendulum Deceleration	1 ms	m/s	0.00 to -0.05	-0.03	Pass
	3 ms	m/s	-0.25 to -0.375	-0.32	Pass
	14 ms	m/s	-3.20 to -3.70	-3.34	Pass
Maximum Flexion Angle		deg	49.0 to 59.0	50.5	Pass
Time of Maximum Flexion Angle		ms	54.0 to 66.0	60.2	Pass
Head Rotation Decay Time to 0 degree		ms	53.0 to 88.0	55.9	Pass
			Overall Test Results		Pass

Jessica Hall
Laboratory Technician

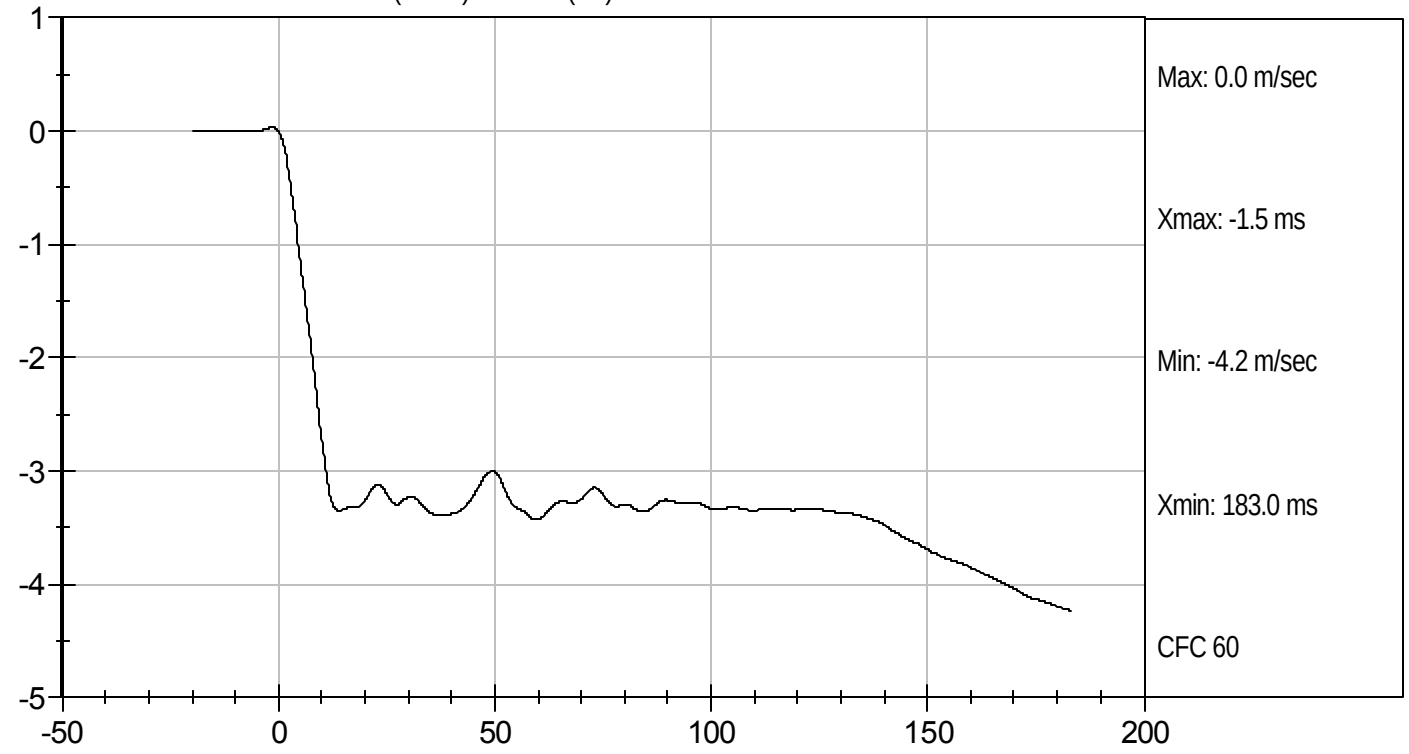
3/9/11
Test Date

David Winkelbauer
Approved By

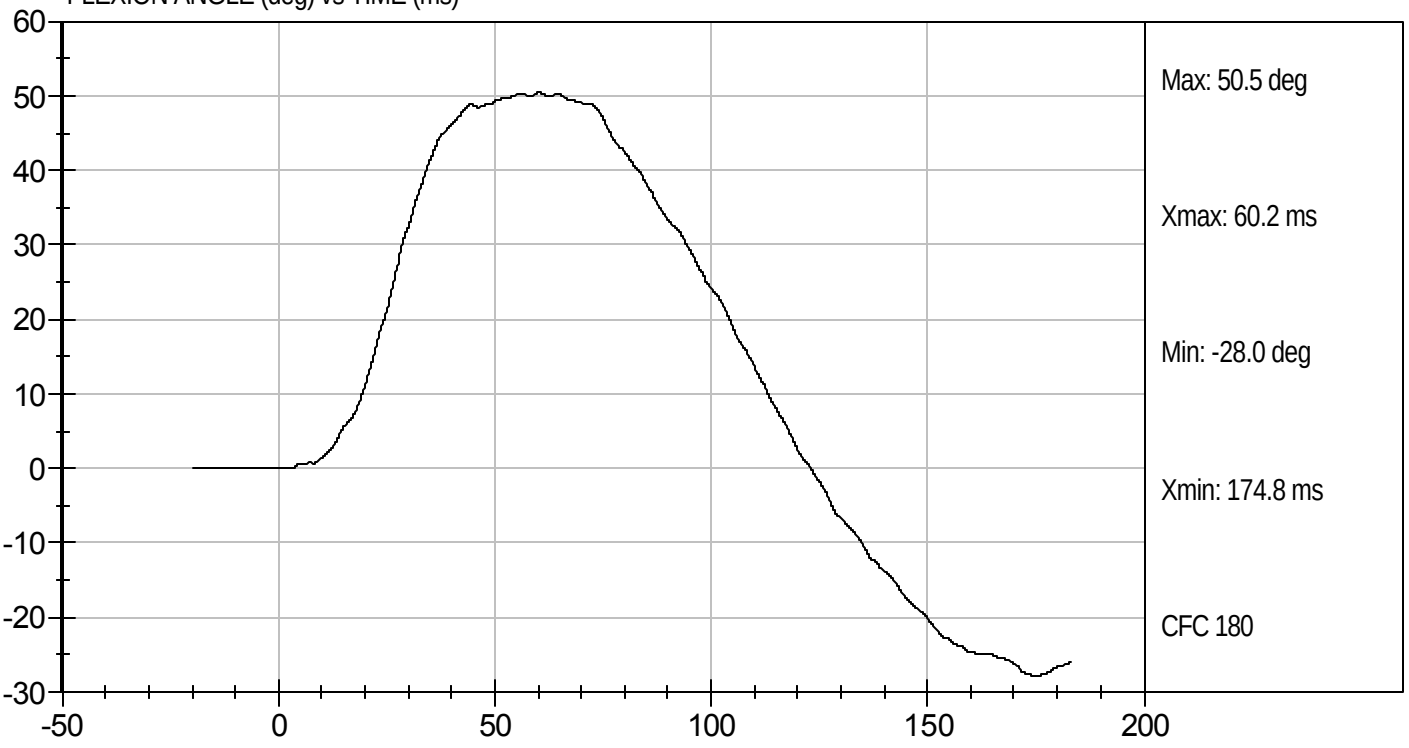
Test Desc: Neck Bending
Component ID: D11892

Test Date: 3/9/11
Velocity: 11.11 ft/s, 3.4 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

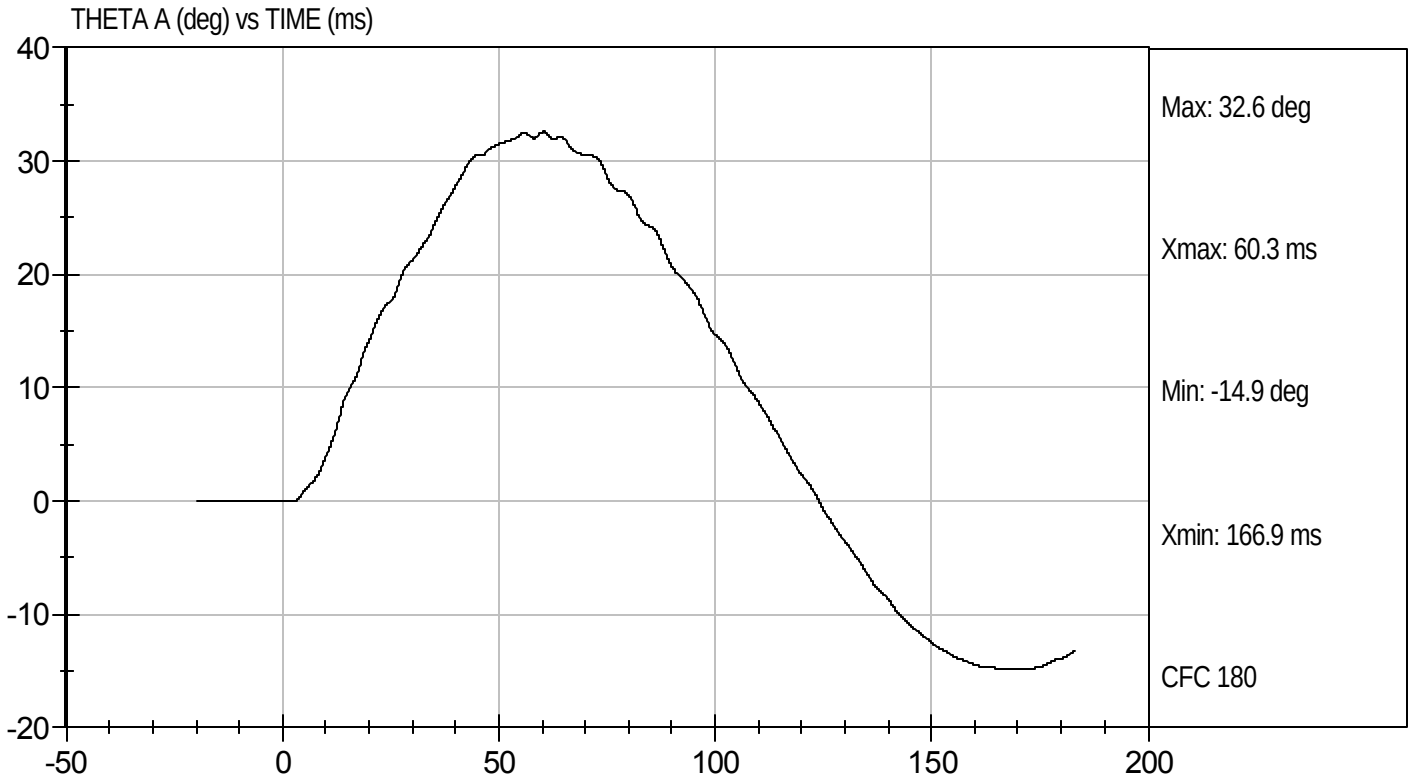


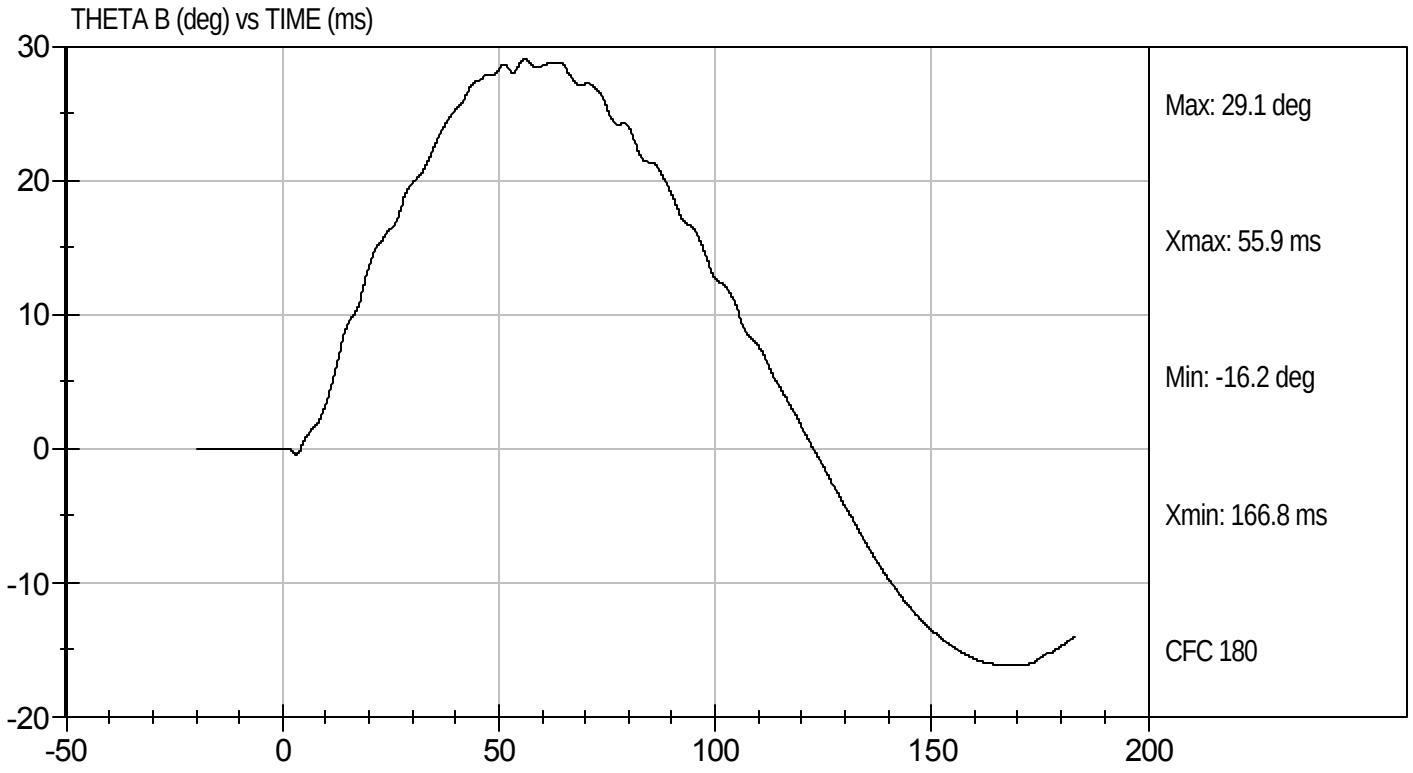
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Neck Bending
Component ID: D11892

Test Date: 3/9/11
Velocity: 11.11 ft/s, 3.4 m/s





MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11893

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Pendulum Speed	m/s	4.2 to 4.4	4.4	Pass
Peak Shoulder Acceleration	G's	7.5 to 10.5	7.6	Pass
Time of Peak Shoulder Acceleration	ms	NA	12.6	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

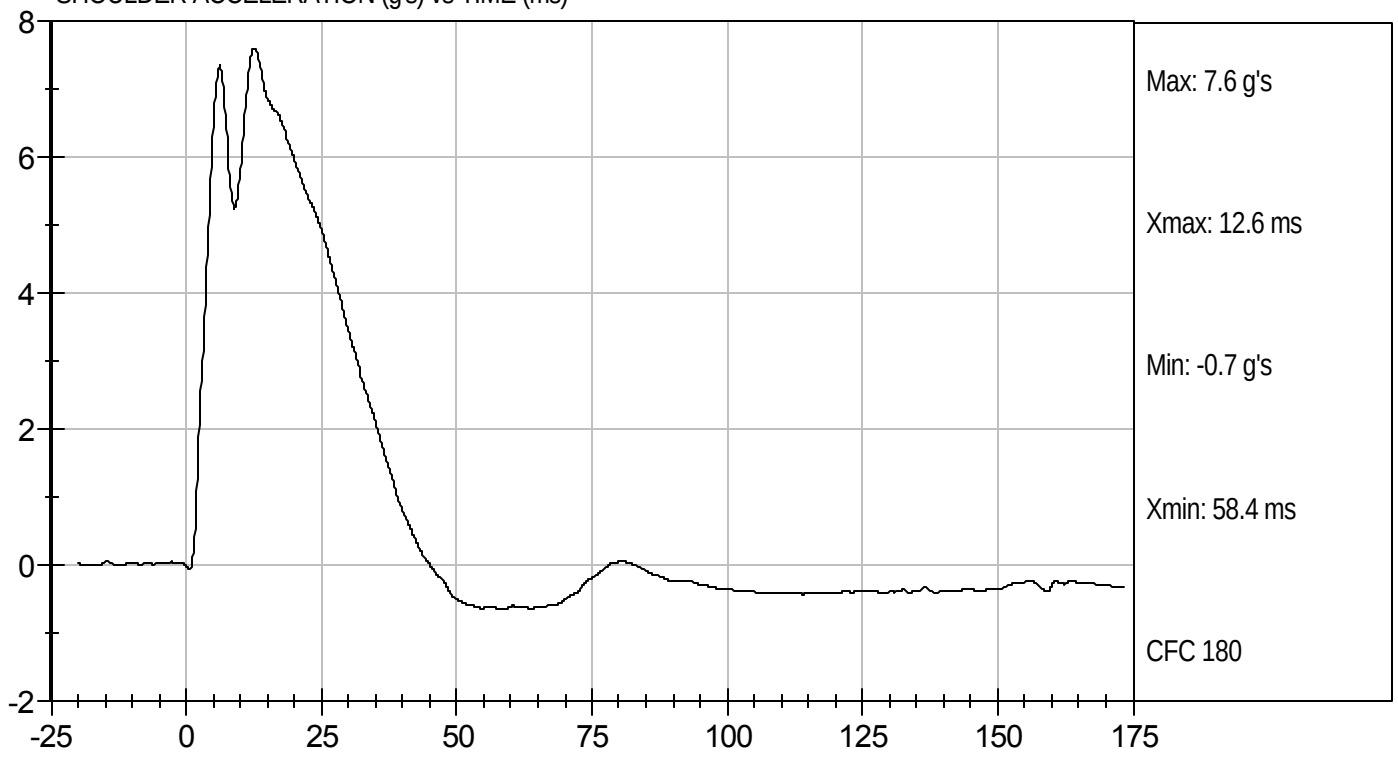
3/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Shoulder Impact
Component ID: D11893

Test Date: 3/9/11
Velocity: 14.36 ft/s, 4.4 m/s

SHOULDER ACCELERATION (g's) vs TIME (ms)



MGA RESEARCH CORPORATION

UPPER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11894

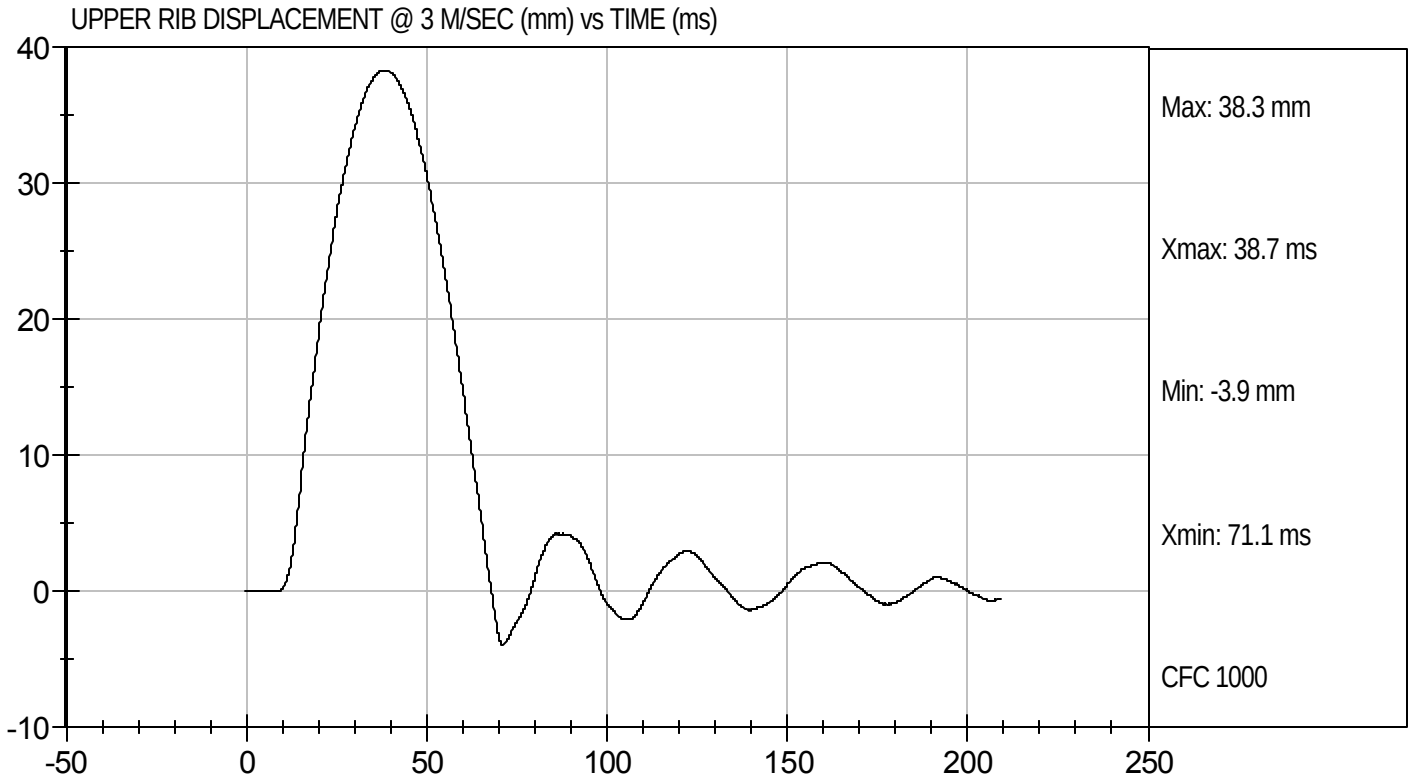
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.3	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.2	Pass
		Overall Test Results		Pass

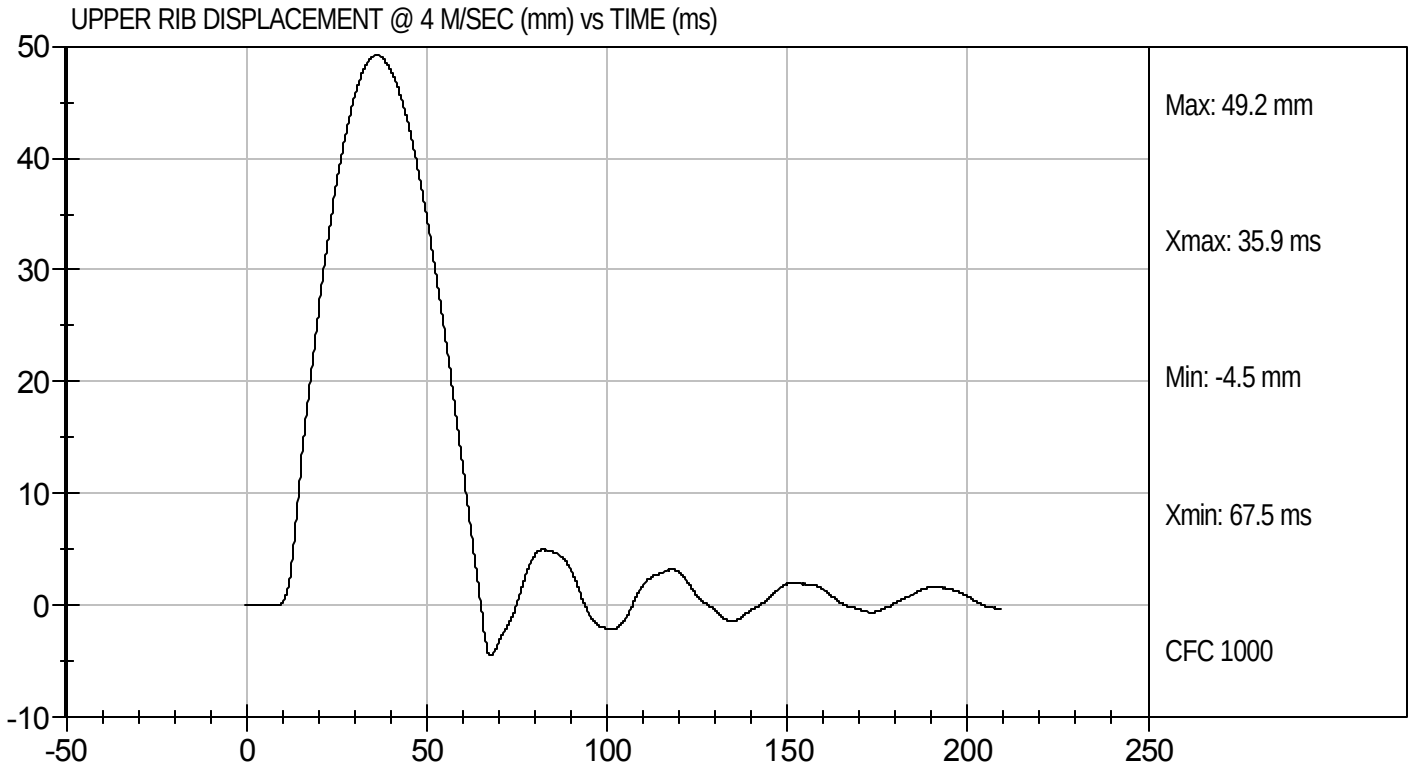
Jessica Hall
Laboratory Technician

3/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Rib Impact - Upper
Component ID: D11894
Test Date: 3/9/11





MGA RESEARCH CORPORATION

MID RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11895

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	39.0	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	50.2	Pass
		Overall Test Results		Pass

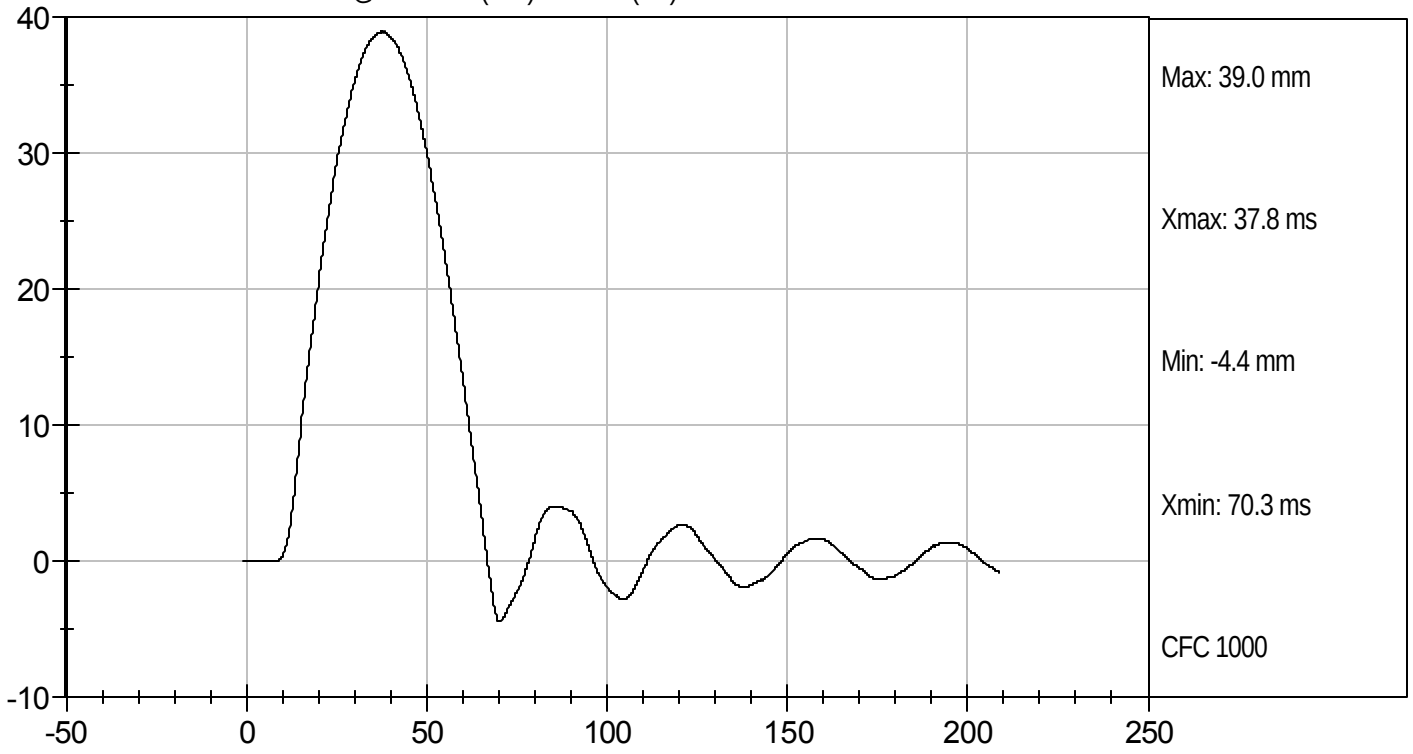
Jessica Hall
Laboratory Technician

3/9/11
Test Date

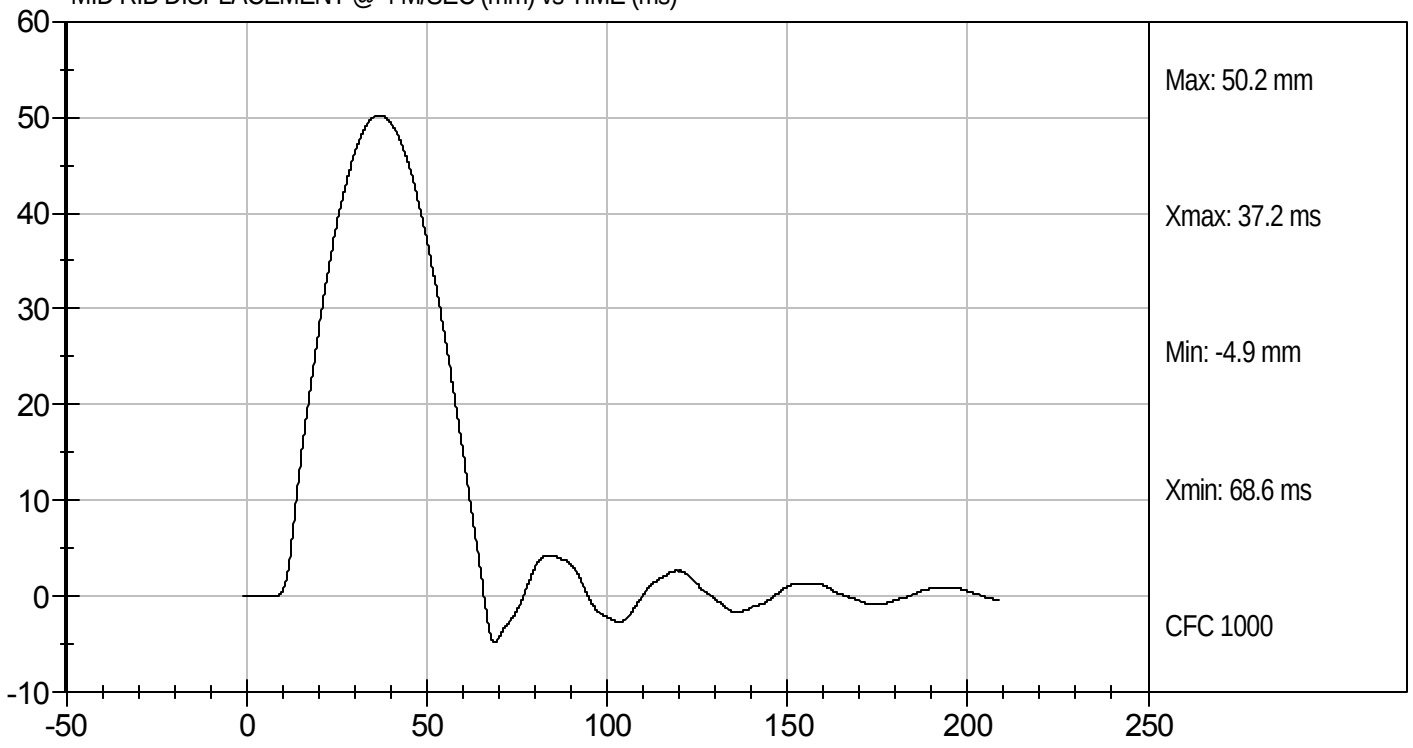
David Winkelbauer
Approved By

Test Desc: Rib Impact - Mid
Component ID: D11895
Test Date: 3/9/11

MID RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



MID RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

LOWER RIB TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11896

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Displacement at 3 m/s	mm	36.0 to 40.0	38.1	Pass
Displacement at 4 m/s	mm	46.0 to 51.0	49.0	Pass
		Overall Test Results		Pass

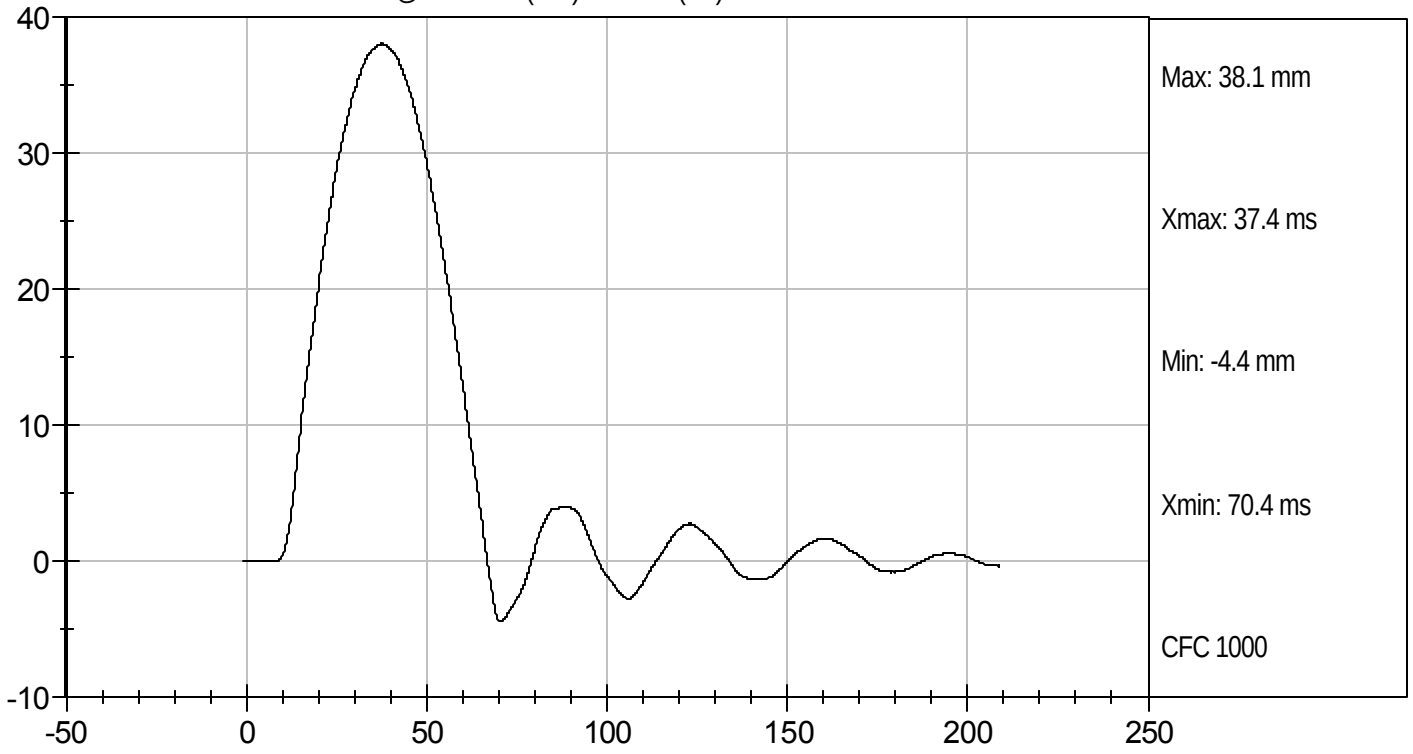
Jessica Gall
Laboratory Technician

3/9/11
Test Date

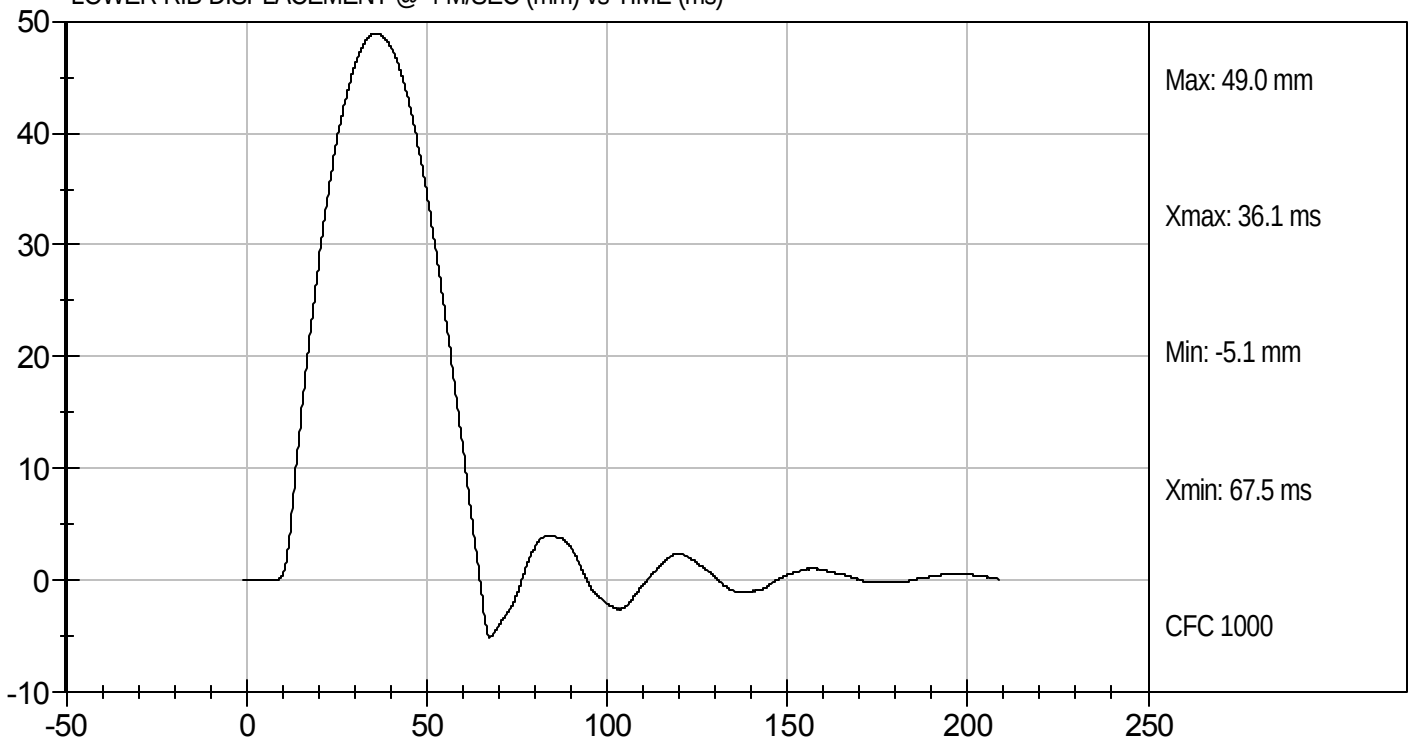
David Winkelbauer
Approved By

Test Desc: Rib Impact - Lower
Component ID: D11896
Test Date: 3/9/11

LOWER RIB DISPLACEMENT @ 3 M/SEC (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT @ 4 M/SEC (mm) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMEN TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11897

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Speed	m/s	3.90 to 4.10	4.06	Pass
Maximum Impact Force	kN	4.00 to 4.80	4.13	Pass
Time of Maximum Impactor Force	ms	10.60 to 13.00	11.10	Pass
Maximum Total Abdomen Force	kN	2.20 to 2.70	2.49	Pass
Time of Maximum Abdomen Force	ms	10.00 to 12.30	11.00	Pass
		Overall Test Results		Pass

Jessica Gall
Laboratory Technician

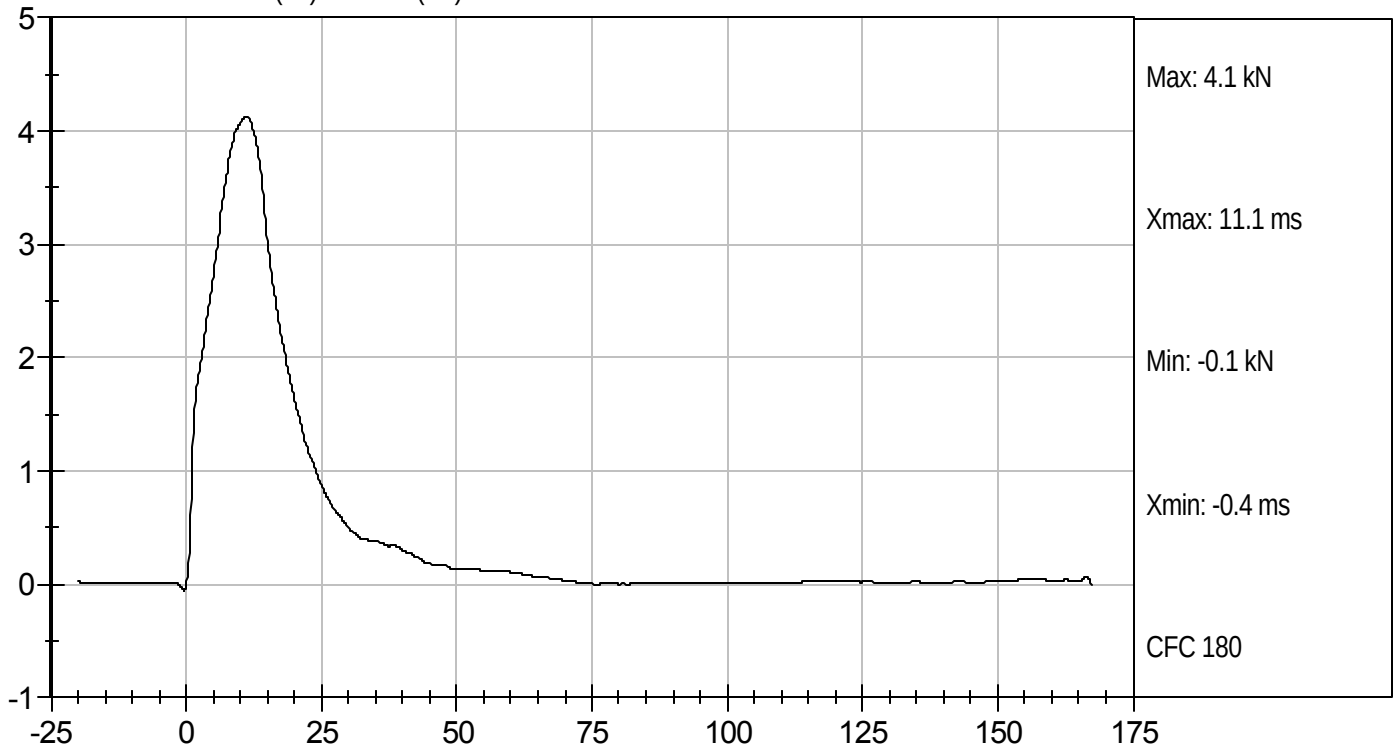
3/9/11
Test Date

David Winkelbauer
Approved By

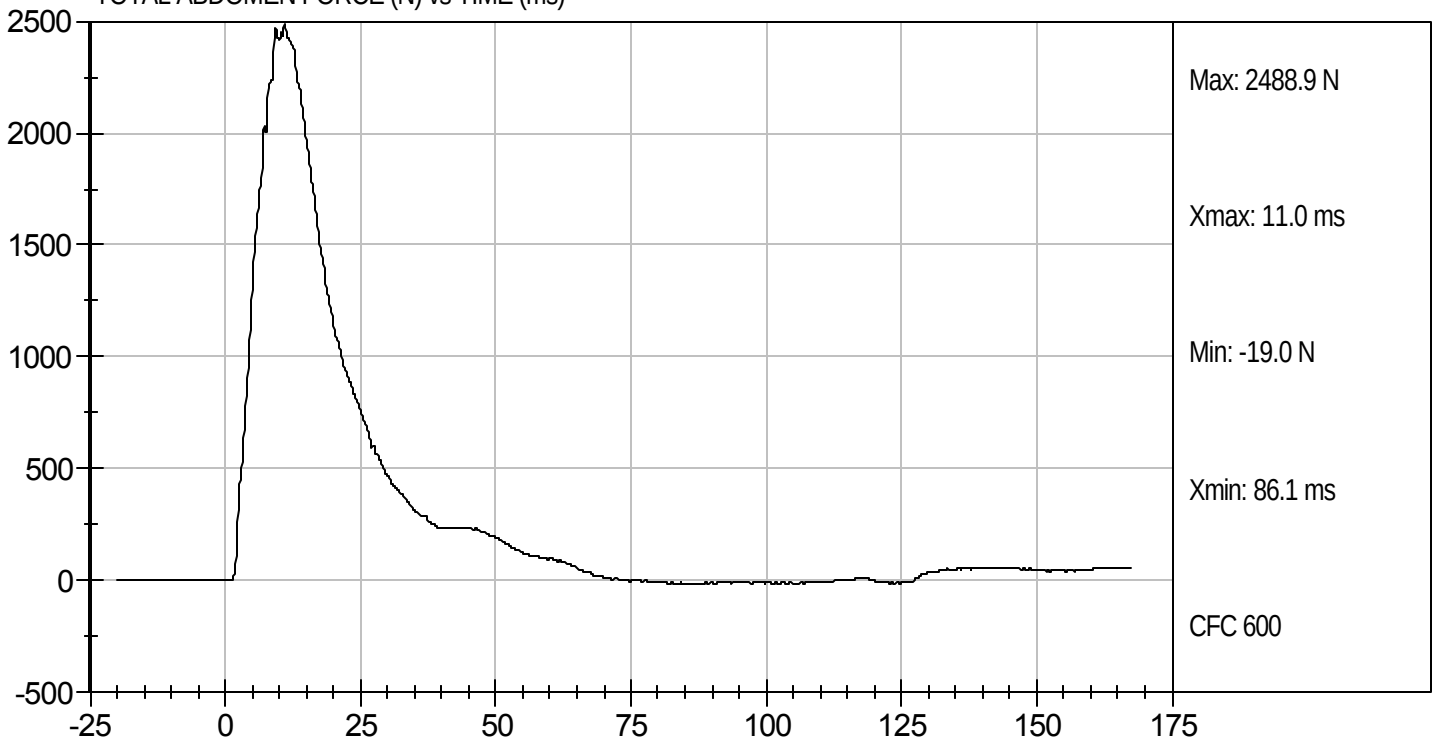
Test Desc: Abdomen Impact
Component ID: D11897

Test Date: 3/9/11
Velocity: 13.33 ft/s, 4.06 m/s

IMPACTOR FORCE (kN) vs TIME (ms)



TOTAL ABDOMEN FORCE (N) vs TIME (ms)



MGA RESEARCH CORPORATION

LUMBAR SPINE TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11898

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	31	Pass
Pendulum Speed		m/s	5.95 to 6.15	6.12	Pass
Pendulum Deceleration	1 ms	m/s	-0.05 to 0.00	-0.02	Pass
	3.7 ms	m/s	-0.425 to -0.24	-0.421	Pass
	27 ms	m/s	-6.50 to -5.80	-6.02	Pass
	30 ms	m/s	>= -6.5	-6.02	Pass
Maximum Flexion Angle		deg	45.0 to 55.0	47.8	Pass
Time of Maximum Flexion Angle		ms	39.0 to 53.0	42.2	Pass
Headform Rotation Decay to Initial Position		ms	37 to 57	43	Pass
			Overall Results		Pass

Jessica Gall
Laboratory Technician

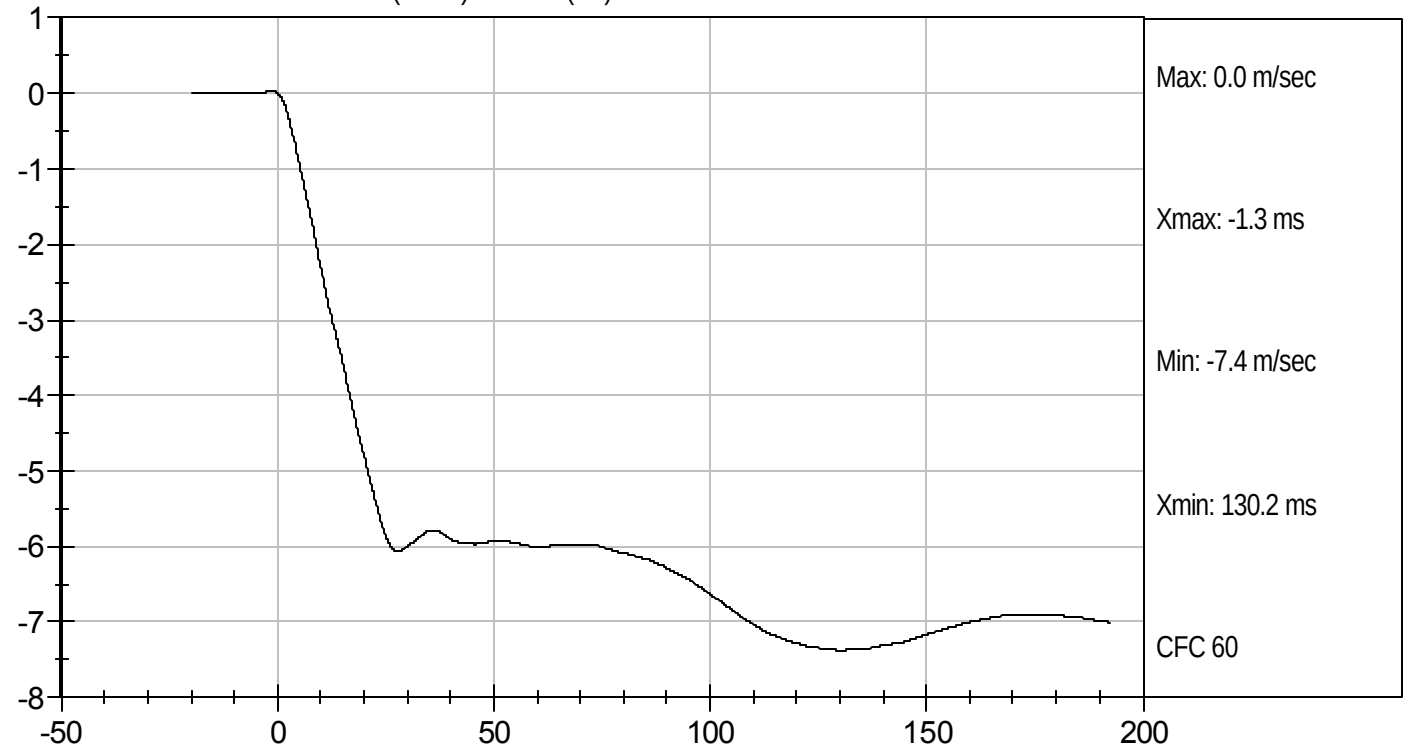
3/9/11
Test Date

David Winkelbauer
Approved By

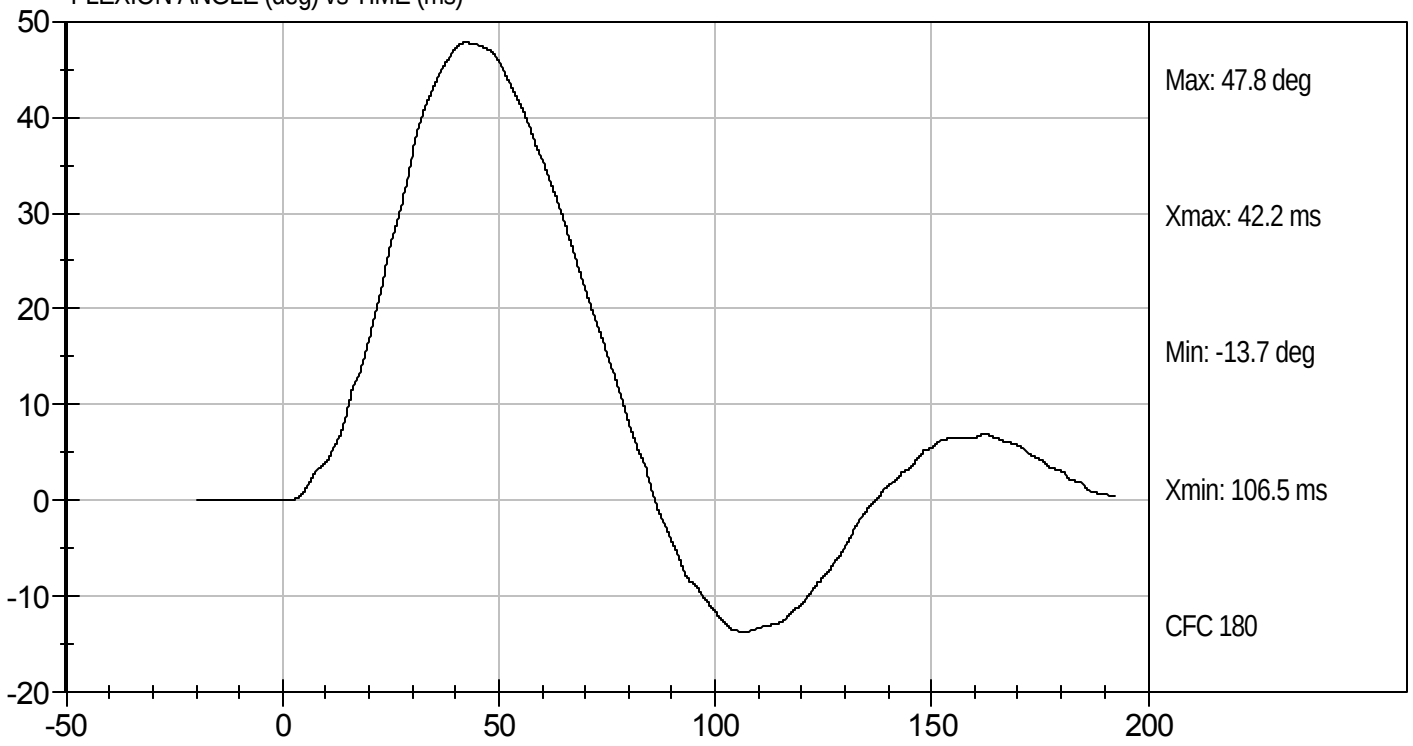
Test Desc: Lumbar Bending
Component ID: D11898

Test Date: 3/9/11
Velocity: 20.08 ft/s, 6.12 m/s

PENDULUM DECELERATION (m/sec) vs TIME (ms)

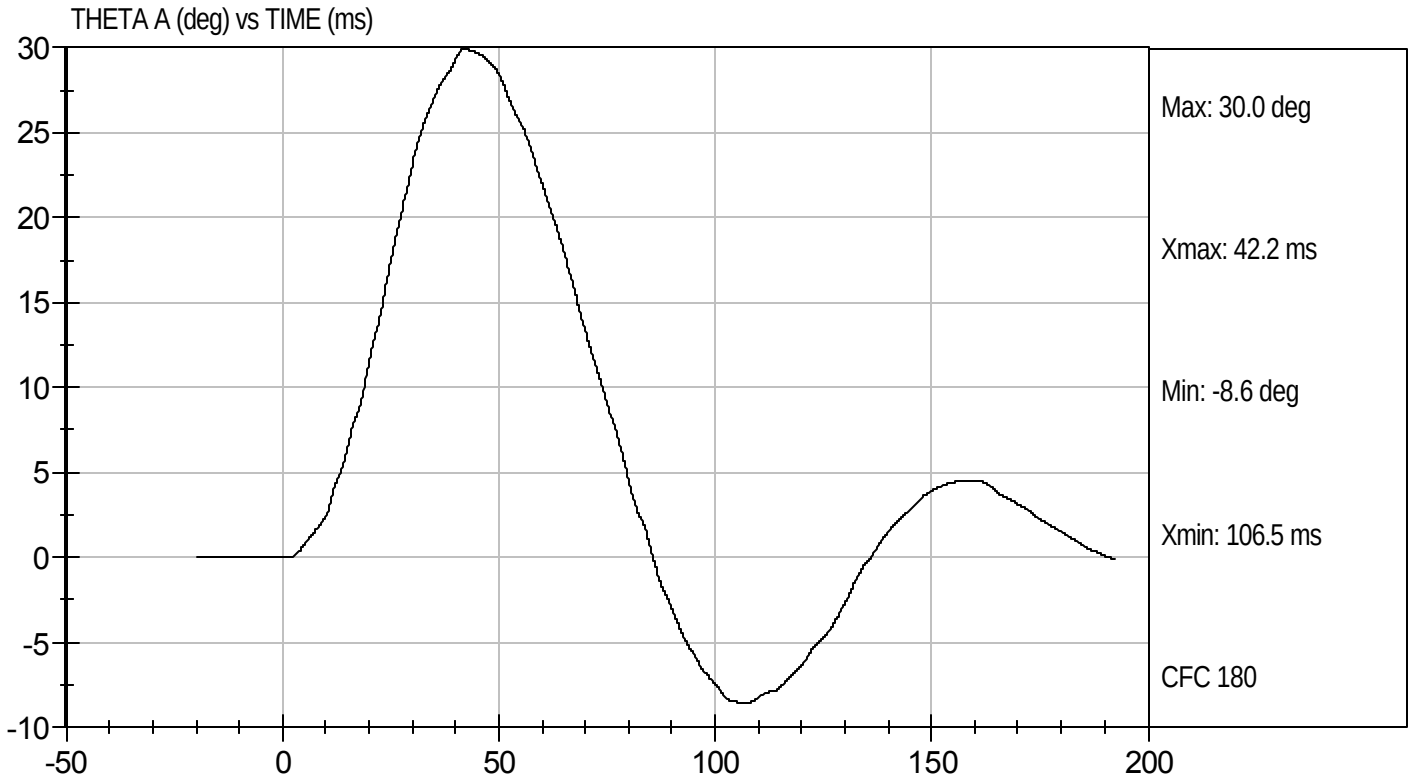


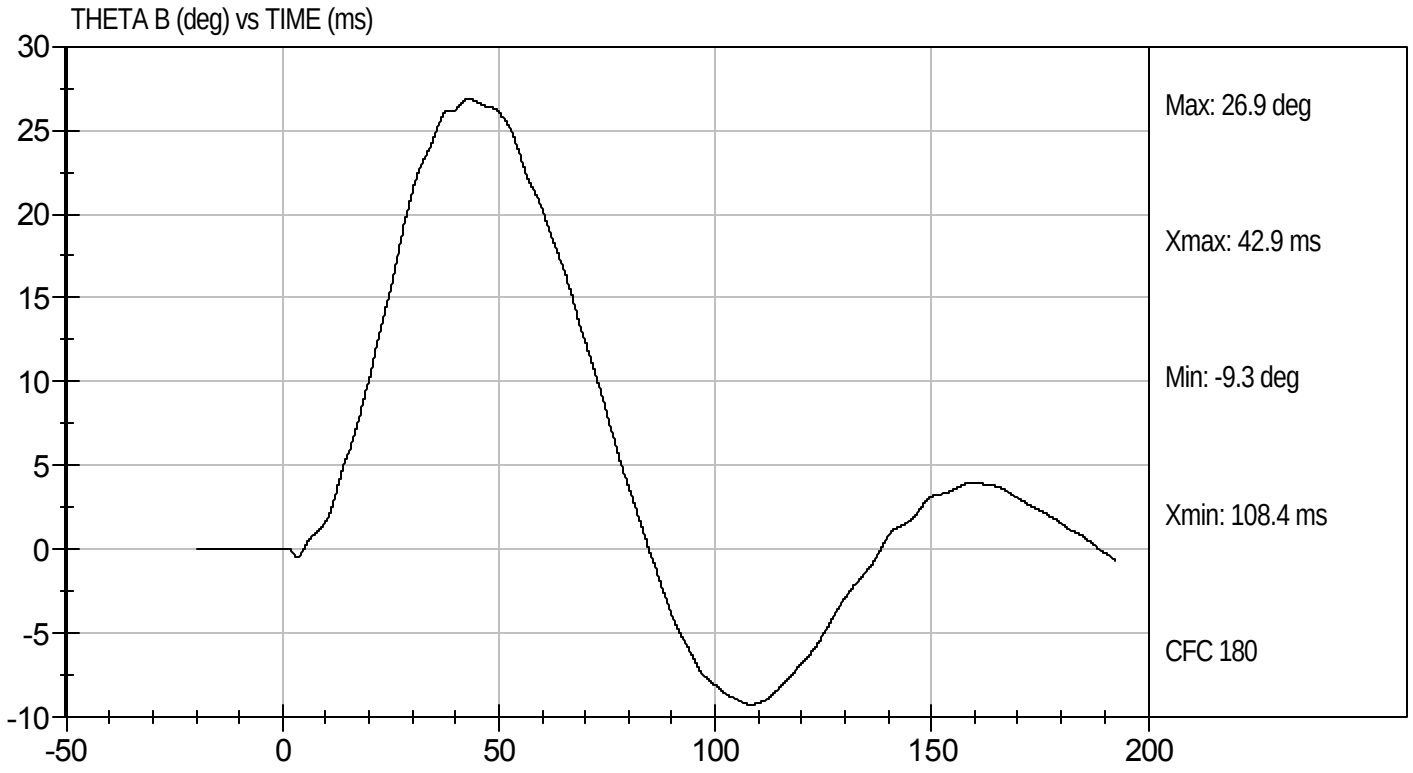
FLEXION ANGLE (deg) vs TIME (ms)



Test Desc: Lumbar Bending
Component ID: D11898

Test Date: 3/9/11
Velocity: 20.08 ft/s, 6.12 m/s





MGA RESEARCH CORPORATION

PELVIS TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11899

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Probe Speed	m/s	4.20 to 4.40	4.34	Pass
Maximum Impactor Force	kN	4.70 to 5.40	4.71	Pass
Time of Maximum Impactor Force	ms	11.80 to 16.10	13.50	Pass
Maximum Pubic Force	kN	1.23 to 1.59	1.37	Pass
Time of Maximum Pubic Force	ms	12.20 to 17.00	14.50	Pass
		Overall Test Results		Pass

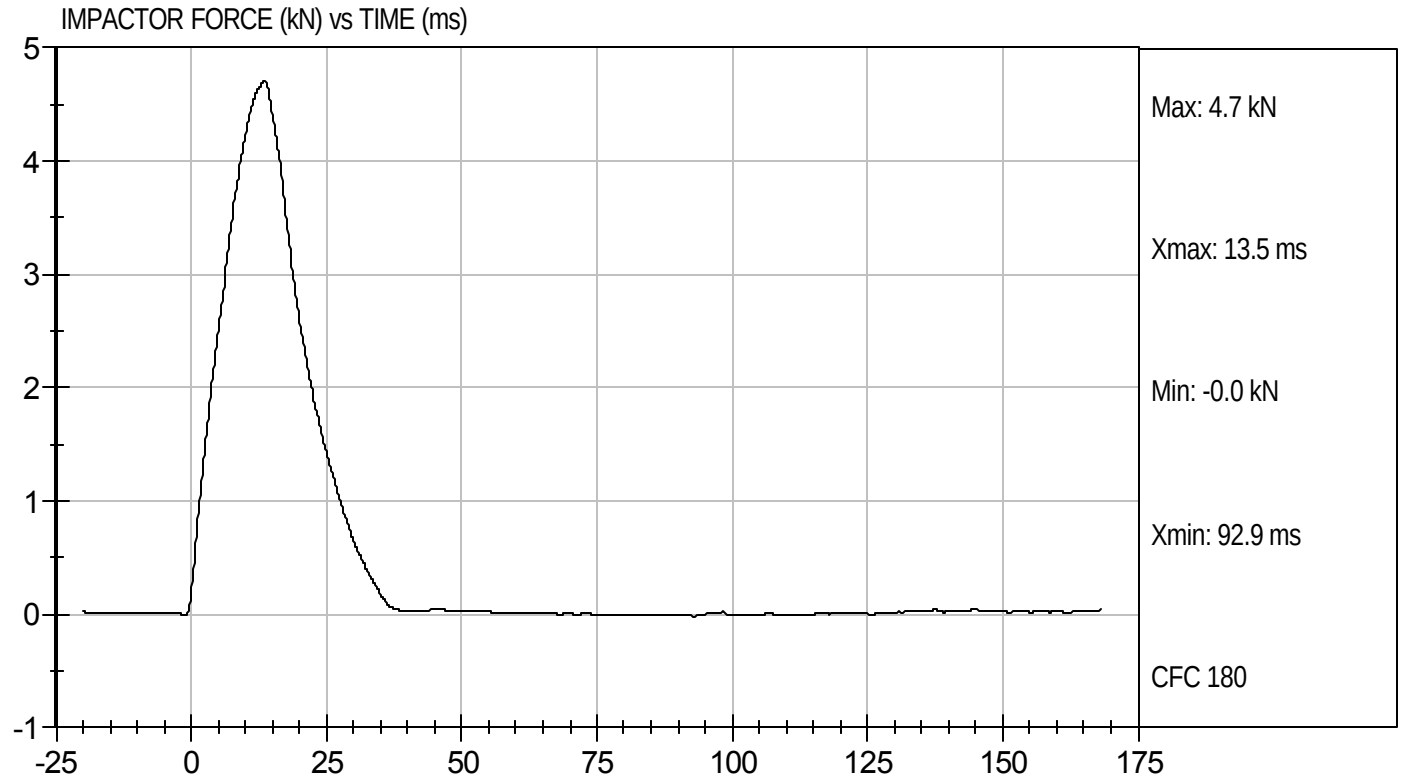
Jessica Gall
Laboratory Technician

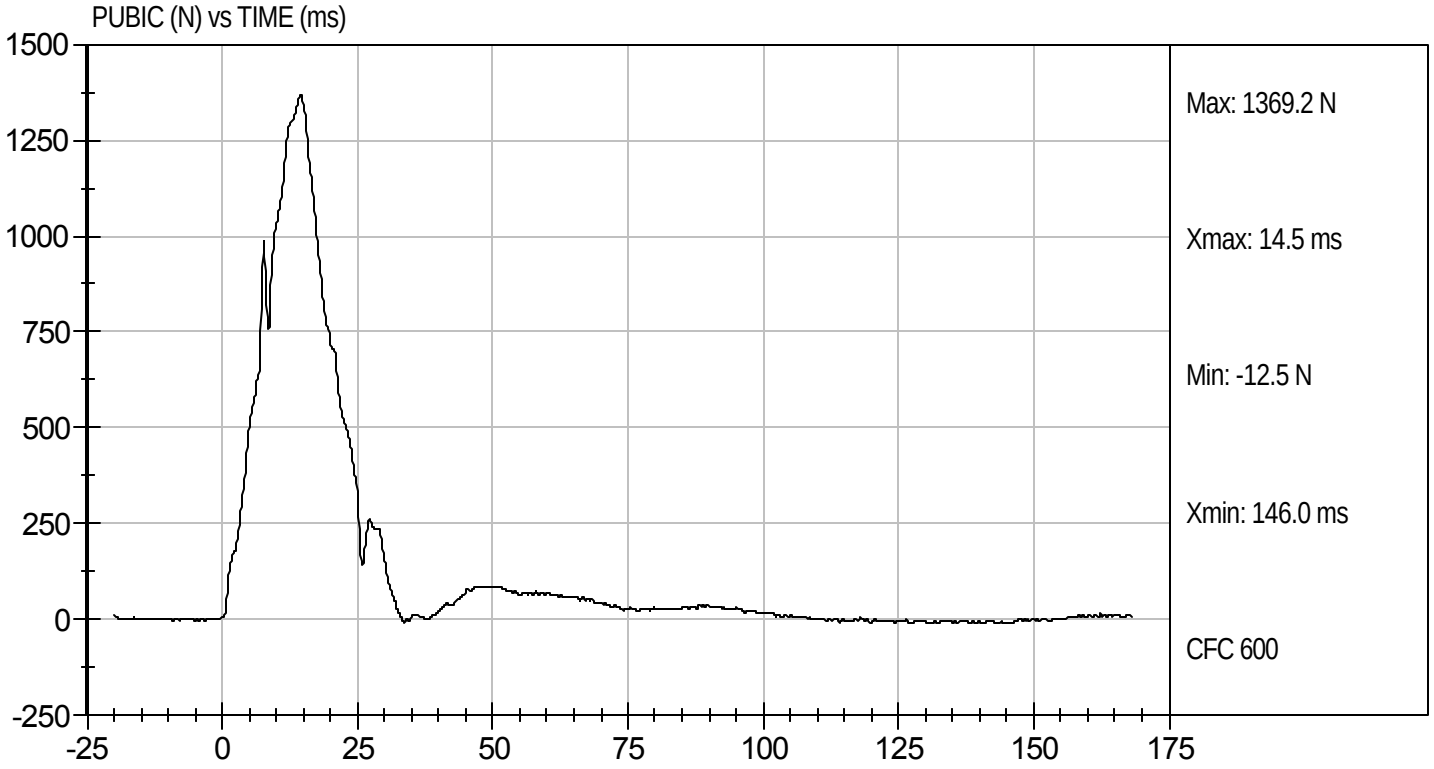
3/9/11
Test Date

David Winkelbauer
Approved By

Test Desc: Pelvis Impact
Component ID: D11899

Test Date: 3/9/11
Velocity: 14.24 ft/s, 4.34 m/s





MGA RESEARCH CORPORATION

FULL BODY THORAX IMPACT TEST

ES-2re DUMMY

ATD Serial No: 016 **Test I.D:** D11890

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Humidity	%	10 to 70	30	Pass
Probe Speed	m/s	5.40 to 5.60	5.58	Pass
Maximum Impactor Force (after 6 ms)	kN	5.10 to 6.20	5.15	Pass
Upper Rib Displacement	mm	34.0 to 41.0	39.2	Pass
Middle Rib Displacement	mm	37.0 to 45.0	41.3	Pass
Lower Rib Displacement	mm	37.0 to 44.0	40.5	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

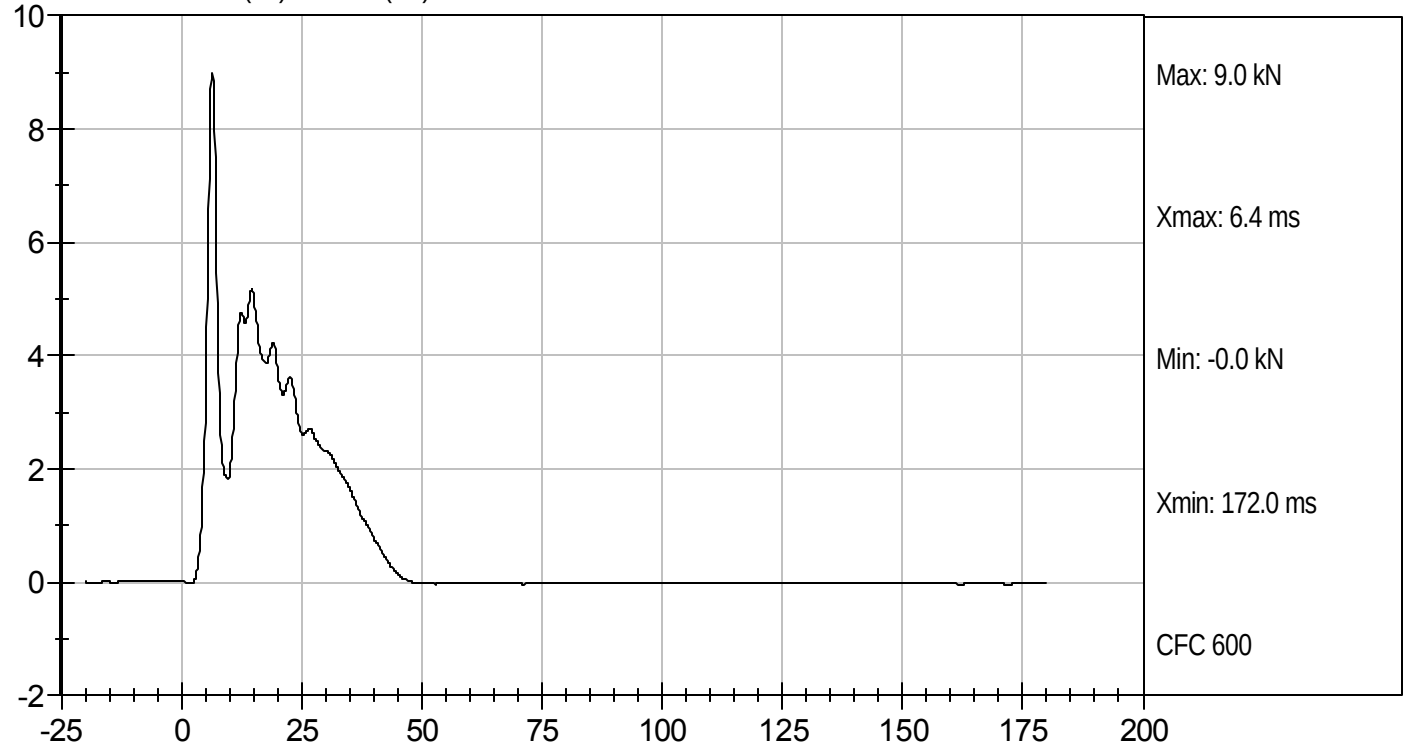
3/9/11
Test Date

David Winkelbauer
Approved By

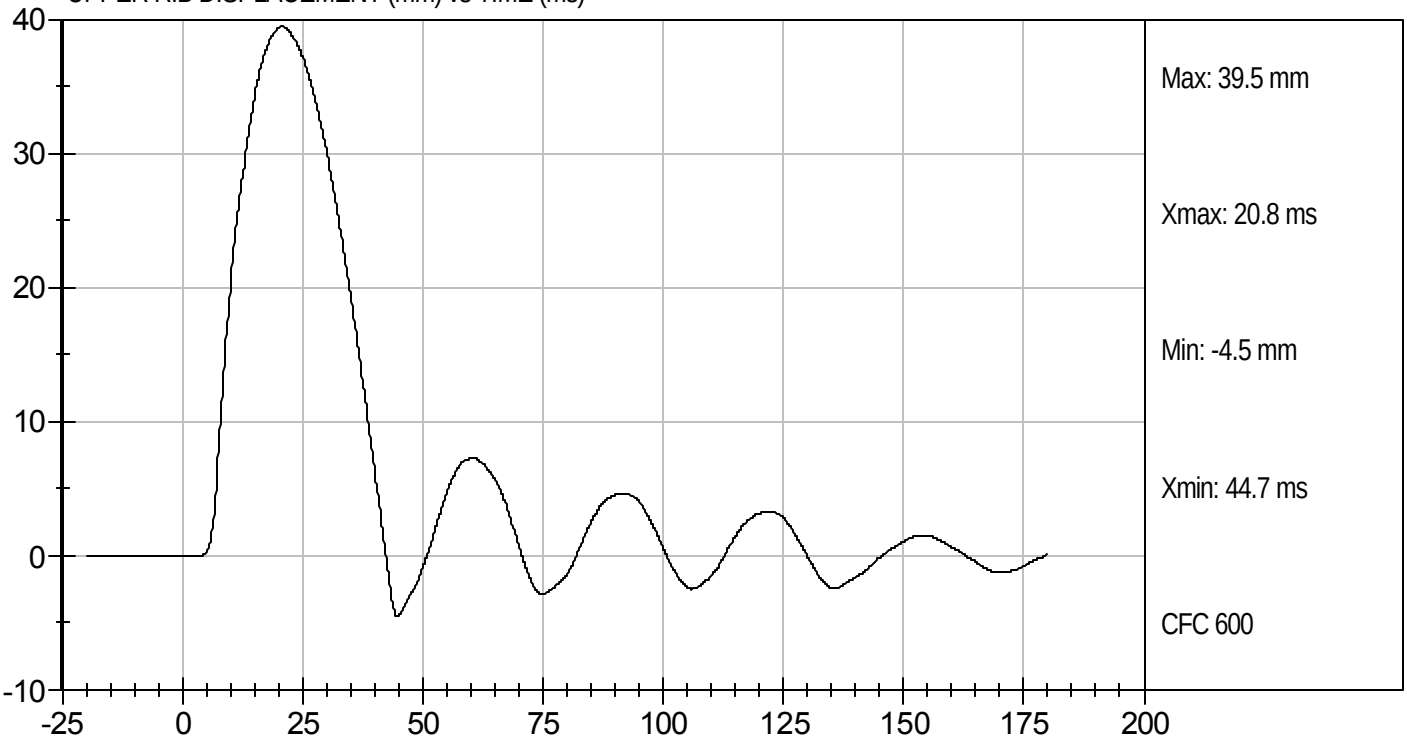
Test Desc: Thorax Impact
Component ID: D11890

Test Date: 3/9/11
Velocity: 18.32 ft/s, 5.58 m/s

PROBE FORCE (kN) vs TIME (ms)



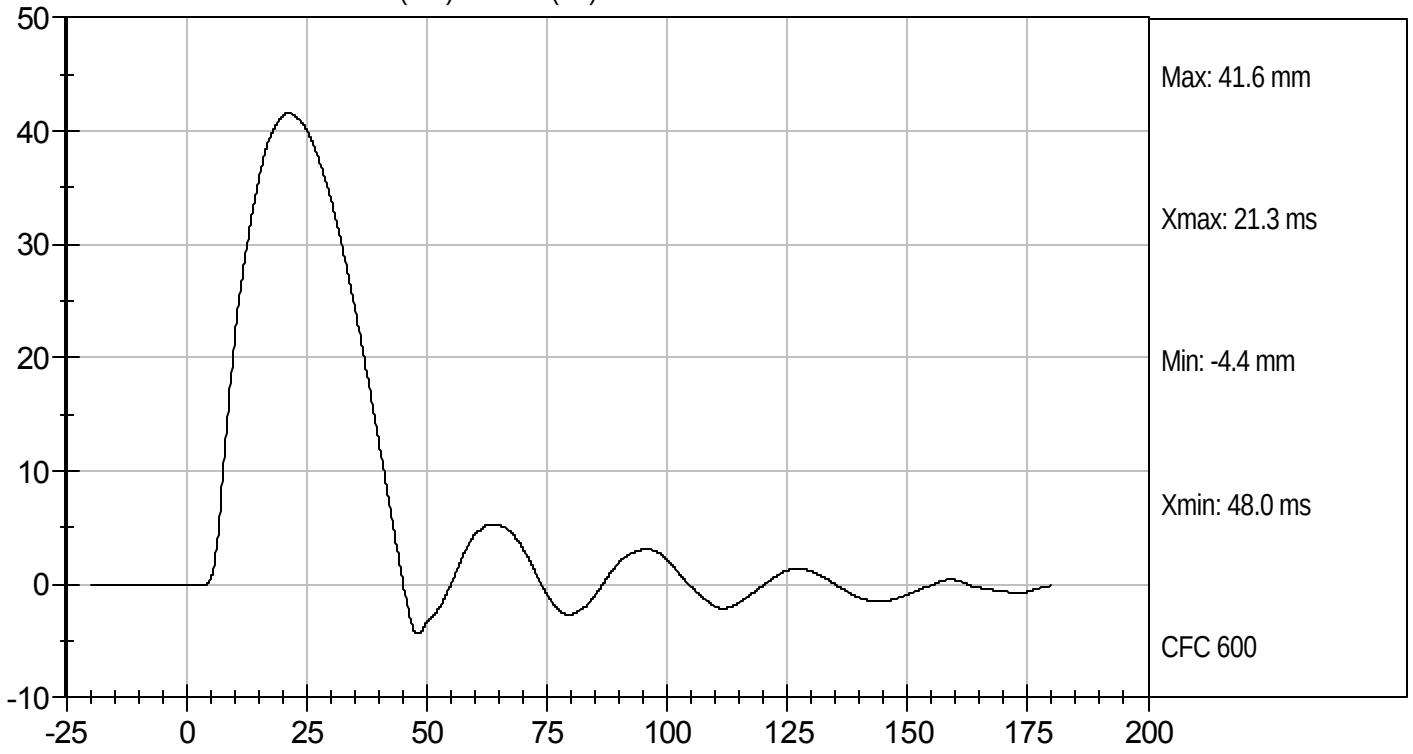
UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



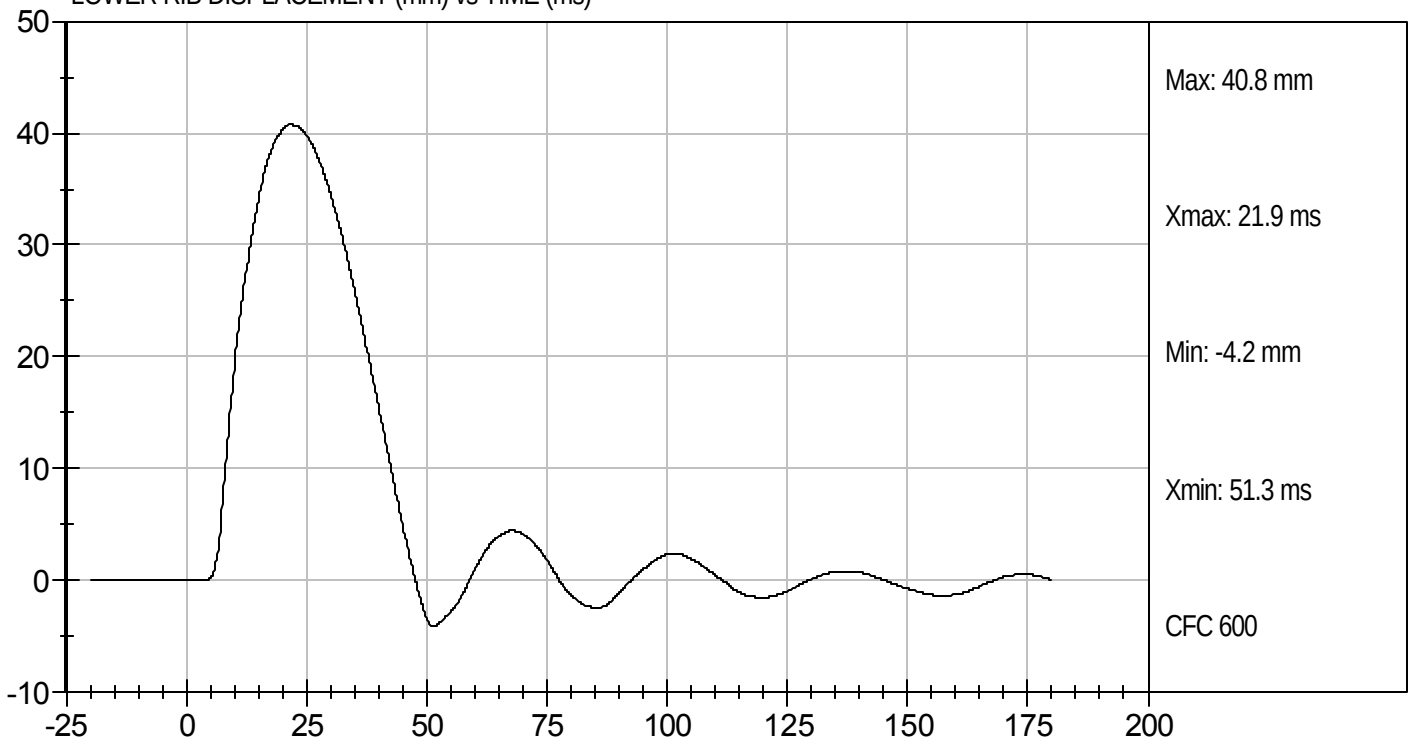
Test Desc: Thorax Impact
Component ID: D11890

Test Date: 3/9/11
Velocity: 18.32 ft/s, 5.58 m/s

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



APPENDIX E

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

Table 1 – Dummy Instrumentation

		ES-2re S/N: 016		
		Serial Number	Manufacturer	Calibration Date
Head Accelerometers	X	P66854	Endevco	2/14/2011
	Y	P66855	Endevco	2/14/2011
	Z	P66856	Endevco	2/14/2011
Thorax Potentiometers	Upper Rib (Y)	G144	Honeywell	2/17/2011
	Middle Rib (Y)	G143	Honeywell	2/17/2011
	Lower Rib (Y)	G142	Honeywell	2/17/2011
Abdomen Load Cells	Forward (Y)	ABG119	FTSS	11/01/2010
	Middle (Y)	ABG120	FTSS	11/01/2010
	Rear (Y)	ABG121	FTSS	11/01/2010
Pubic Symphysis Load Cell (Y)		PG431	Denton	11/01/2010

Table 2 – Vehicle Instrumentation

	Serial Number	Manufacturer	Calibration Date
Vehicle CG (X)	P52170	Endevco	10/01/2010
Vehicle CG (Y)	P52171	Endevco	10/01/2010
Vehicle CG (Z)	P52172	Endevco	10/01/2010
Left Floor Sill (Y)	P47881	Endevco	11/05/2010
A Pillar Sill (Y)	P59634	Endevco	11/05/2010
A Pillar Low (Y)	P59249	Endevco	12/13/2010
A Pillar Mid (Y)	P55725	Endevco	11/05/2010
B Pillar Sill (Y)	P49503	Endevco	1/13/2011
B Pillar Low (Y)	P55682	Endevco	10/11/2010
B Pillar Mid (Y)	P55715	Endevco	11/05/2010
Seat (Y)	P38350	Endevco	1/13/2011
Engine (X)	P49490	Endevco	9/22/2010
Engine (Y)	P49491	Endevco	9/22/2010
Firewall (Y)	P59296	Endevco	11/05/2010
Roof (Y)	P59360	Endevco	1/13/2011
Floor Sill (Y)	P59342	Endevco	12/22/2010
Rear Deck (X)	P52269	Endevco	12/13/2010
Rear Deck (Y)	P52268	Endevco	12/13/2010